ABSTRACT

OF

The Proceedings of the Forty-seventh Annual Meeting of the Association of Life Insurance Medical Directors of America

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An Abstract of the Proceedings

OF THE

Association of Life Insurance Medical Directors of America

FORTY-SEVENTH ANNUAL MEETING

The Forty-seventh Annual Meeting of the Association of Life Insurance Medical Directors of America was held at the Hotel Pennsylvania, New York City, on October 22 and 23, 1936.

The following members, delegates and guests were present at some time during the sessions: Doctors J. W. Abbott, G. E. Allen, H. H. Amiral, T. D. Archibald, E. M. Armstrong, W. B. Aten, H. A. Bancel, W. B. Bartlett, J. T. J. Battle, E. W. Beckwith, J. E. Bee, M. B. Bender, F. M. Beresford, J. R. Biggs, C. C. Birchard, W. F. Blackford, H. E. Bogart, J. E. Boland, William Bolt, E. C. Bonnett, J. T. Bowman, W. M. Bradshaw, A. W. Bromer, J. L. Brooks, C. T. Brown, F. R. Brown, H. B. Brown, B. C. Bullen, B. F. Byrd, W. R. Calderwood, E. J. Campbell, R. G. Cannaday, F. H. Carber, P. E. Carlisle, W. E. Chamberlain, C. L. Christiernin, C. P. Clark, Gates Collier, H. W. Cook, P. M. Cort, D. B. Cragin, H. W. Crawford, H. C. Cruikshank, R. M. Daley, H. D. Delamere, P. G. Denker, E. J. Dewees, E. G. Dewis, T. H. Dickson, Jr., E. S. Dillon, J. H. Dunkley, J. T. Eads, O. M. Eakins, J. E. Engelson, J. L. Evans, W. G. Exton, J. G. Falconer, R. K. Farnham, H. H. Fellows, W. E. Ferguson, P. M. Foshay, R. A. Fraser, E. M. Freeland, F. I. Ganot, I. K. Gardner, J. M. Gilchrist, R. A. Goodell, H. W. Goos, R. J. Graves, F. L. Grosvenor, F. W.

Hagney, Llewellyn Hall, Frank Harnden, L. E. Hathaway, W. C. Hausheer, S. D. Hawley, W. D. Heaton, C. E. Herron, W. L. Hilliard, D. W. Hoare, C. O. Hollinger, C. E. Homan, J. C. Horan, J. H. Humphries, Ross Huston, W. G. Hutchinson, W. C. Huyler, C. E. Iliff, A. S. Irving, J. G. Irving, C. B. Irwin, W. A. Jaquith, A. O. Jimenis, G. E. Kanouse, D. G. Kilgore, I. C. Lawler, J. M. Livingston, G. Carroll Lockard, H. C. McAlister, M. T. McCarty, George McCreight, C. B. McCulloch, A. J. McGanity, H. E. McMahon, W. T. McNaughton, F. W. McSorley, H. L. Mann, R. W. Mann, W. L. Mann, R. C. Montgomery, J. F. Moore, Jr., E. B. Mountain, William Muhlberg, R. L. Murdoch, A. E. Murphy, J. R. Neal, C. F. Nichols, J. B. Nichols, E. C. Noble, James Norman, Eduard Novak, Herbert Old, J. A. Patton, W. O. Pauli, C. A. Peters, C. B. Piper, Cullen Pitt, J. E. Pollard, R. W. Pratt, W. W. Quinlan, J. H. Ready, W. P. Reed, Charles Rein, P. V. Reinartz, W. A. Reiter, W. W. Read, G. P. Robb, D. C. Roberts, A. J. Robinson, R. L. Rowley, C. L. Rudasill, S. C. Rumford, E. F. Russell, W. J. Schmidt, S. B. Scholz, Jr., J. T. Sheridan, A. L. Sherrill, D. M. Shewbrooks, R. L. Shields, J. L. Siner, D. W. Skeel, M. K. Smith, Isaac Sossnitz, H. F. Starr, J. B. Steele, D. F. Steuart, I. R. Stidger, A. C. Stokes, A. R. Stone, S. J. Streight, E. V. Sweet, L. G. Sykes, B. C. Syverson, H. F. Taylor, W. E. Thornton, Walter Timme, I. G. Towson, Joseph Travenick, Wallace Troup, H. B. Turner, H. E. Ungerleider, A. P. Upshur, Euen Van Kleeck, H. E. Van Riper, W. R. Ward, F. S. Weisse, G. R. Welch, F. L. Wells, D. E. W. Wenstrand, C. F. S. Whitney, E. S. Williams, C. H. Willis, R. L. Willis, F. C. Wood, G. E. Woodford, L. S. Ylvisaker, and Messrs. L. F. Baker, L. I. Dublin, R. E. Fletcher, Arthur Hunter, G. C. Kingsley, J. R. Larus, H. C. Lawrence, J. B. MacLean, H. H. Marks, Pearce Shepherd, John Thompson, P. V. Wells.

Total attendance at all sessions, 198.

During the past year, nine members of our Association have died. The following testimonials to their memory have been prepared by representatives of the Association.

DR. WESLEY WILBUR BECKETT

Wesley Wilbur Beckett was born in Forest Grove, Oregon, May 31, 1857. He died June 3, 1936, in Los Angeles, California.

After receiving his preliminary education in the public schools of California, he taught school in San Luis Obispo County and was for two years Assistant Superintendent of Schools of that County. In 1885 he entered Cooper Medical College at San Francisco, where he took his first year in medicine. His last two years were taken at the College of Medicine of the University of Southern California at Los Angeles, from which he received the degree of Doctor of Medicine in 1888—a member of the first class to graduate. Following this he took one year of post graduate work in New York City and then returned to Los Angeles where for almost a quarter of a century he practiced medicine and won distinction as an outstanding surgeon.

He was elected a Trustee of the University of Southern California in 1895, in which capacity he served at the time of his passing. For several years he was Professor of Gynecology and Surgery in his Alma Mater.

In the year 1906, Doctor Beckett became identified with the Pacific Mutual Life Insurance Company of California as a member of its Board of Directors. In 1909 he was elected Medical Director of that Company but did not relinquish his practice until 1913, after which he devoted himself to his duties with the Pacific Mutual for the remainder of his life.

Doctor Beckett was President of Southern California Medical Association in 1901; Los Angeles County Medical Association in 1904; The Clinical and Pathological Society in 1906; The California Medical Association in 1909 and he presided over the Association of Life Insurance Medical Directors in 1926-1927.

The degree of LL.D. was conferred upon him by the University of Southern California in 1927 in recognition of his service in med-

ical education. He looked upon the Medical Department of the University of Southern California as peculiarly his field and took the lead in reopening this Department in 1928, contributing most liberally to its financial support.

The Doctor was a man of high ideals, strong convictions, genuine sincerity and great tenacity of purpose. Excelling in what might be classed as the more rugged qualities of character, there was yet no forbidding severity in his make-up. He was one of the kindliest of men and had great capacity for friendship. Always thoughtful, he could be counted on to do the generous thing. It is because of this latter quality more than any other that those who knew him best will always cherish his memory.

DR. HENRY DILLARD

Henry Dillard, an Assistant Medical Director of The Penn Mutual Life Insurance Company, died on May 17, 1936.

Dr. Dillard was born in Philadelphia in 1877 and lived in that city his entire lifetime. After completion of his preliminary education he entered the University of Pennsylvania, College Department, and later transferred to the Medical Department, graduating in 1902. After his graduation he interned in three prominent Philadelphia hospitals—Pennsylvania, Children's, and the Municipal.

His first medical life insurance experience was with The Penn Mutual, when in 1906 he acted in an examiner capacity. In 1915 he was elected Assistant Medical Examiner, and continued in this position until he left for service in the World War. He sailed with one of the first hospital units to France, Base Hospital No. 10, stationed at Treport, where he was wounded. He recuperated in England, and after recovery he was in charge of a convalescent hospital, and later was attached to a division of the English Army. At the end of the war he went with the Army of Occupation to Germany, and was discharged with the rank of Major, Medical Corps, U. S. Army.

With a composite knowledge of medicine, a long clinical and examining experience, Dr. Dillard was adequately fitted for the office, when in 1924 he was elected Assistant Medical Director of

The Penn Mutual. He earned the confidence and respect of his colleagues and assistants by the depth of his insight and understanding of the specialized problems of medical selection. He continued in this post until the time of his death, completing thirty years of service with The Penn Mutual.

Aside from his professional accomplishments, Dr. Dillard was a gentleman of culture. In his travels in this country and abroad he had a rare faculty of absorbing and interpreting the finer characteristics of the people, and he reflected the fruits of a keen observation which bespoke a thorough appreciation of those with whom he associated. His gracious personality and fine personal bearing created a lasting impression of complete social grace.

Dr. Dillard was a member of the Delta Psi Fraternity, the American Medical Association, the College of Physicians of Philadelphia, and many other prominent medical and social organizations.

His many friends and associates mourn his passing and feel his absence as a deep personal loss.

DR. ERNEST H. LINES

The distinguished career of Dr. Ernest H. Lines came to a close at his home in Topsfield, Massachusetts, on April 17, 1936. Dr. Lines was former Chief Medical Director of the New York Life Insurance Company, retiring from that position September 1, 1934.

Dr. Lines was born at Dunkirk, New York, October 22, 1859. He was educated at St. Johnsbury Academy in Vermont and then entered Dartmouth University, from which he graduated in 1882. During his college years he was an outstanding leader in college activities, taking an active part in all college sports. He played center on the first football team of his college and was the manager of the baseball team.

He graduated with Phi Beta Kappa honors and was an enthusiastic DKE, representing the local chapter at several national conventions.

In 1886 he graduated from the College of Physicians and Surgeons in New York, thereafter spending three years as house surgeon in the New York Hospital. He also was connected with the

New York Dispensary. In 1889 he entered the service of the New York Life Insurance Company as medical examiner. In 1890 he was appointed Associate Medical Director for the Company in Paris, with medical jurisdiction over the selection and rating of cases for Europe and Northern Africa. In 1903 he was promoted to the position of Medical Director for the Company in Europe. His service in Europe was long and brilliant, until after the discontinuance of the Company's foreign business following the World War.

After the terrible disaster at Messina, Italy, in 1908, the work of Dr. Lines in attempting to establish the identity of thousands of persons insured in American life insurance companies rendered him a notable figure. Dr. Lines' duties in Europe called him to all important European centers and necessitated his acquiring a knowledge of many European languages. He was a well-known figure in American-Parisian life and for several years held the position of President of the American Club in Paris. During the World War he acted as medical chief of a hospital for rehabilitation of wounded French soldiers and, in gratitude for this service, the French Government conferred upon him the decoration of Chevalier of the Legion of Honor, the presentation being made at the War College by General Gouraud.

It was during this war period that "Daddy" Lines of former Dartmouth days became an international figure as "Uncle" Lines, and as such he was known to the officers of the Canadian Contingent when they required a pass into Paris during war service. He was the most beloved "uncle" of the greatest number of "nephews" that Canada ever had.

Dr. Lines was married September 18, 1889, to Miss Elizabeth L. James of Burlington, New Jersey. Their union was blessed with a son and a daughter. The son, Howard, also a graduate of Dartmouth in 1912, entered the American Ambulance Service under the French flag, won the Croix de Guerre, but died in the Argonne on December 23, 1916. The shock of his son's death and of the suffering endured at the time of the Titanic tragedy in 1912, when doubts of the safety of his wife and daughter were borne by him,

undoubtedly caused the weakening of his heart which eventually brought about his death.

Dr. Lines returned to New York in July, 1920, to resume his work at the Home Office of the New York Life Insurance Company. In 1929 he was appointed Chief Medical Director of the Company and held this position until his retirement in 1934.

To those associated with him he was a loyal and delightful friend and companion, to his family a devoted and much beloved husband, father and grandfather. He was honored and loved by his associates in all departments of the Company, and the news of his passing to his reward was received with profound regret.

DR. BRACE WHITMANN PADDOCK

Dr. Brace Whitmann Paddock, Assistant Medical Director of the Berkshire Life Insurance Company, died at his home in Pittsfield, Massachusetts, on May 22, 1936, after an illness of six months. A native of Pittsfield, he was born August 14, 1878, son of the late Dr. Franklin Paddock and Anna Todd Paddock. His father was a prominent Berkshire physician.

Dr. Paddock was graduated from Hotchkiss School and from Yale in 1900 and from Columbia College in 1904. For two years he was on the staff of Roosevelt Hospital and he also was house physician at Sloane Maternity Hospital, New York. Since 1907, Dr. Paddock had been on the staff of the House of Mercy Hospital, in Pittsfield, succeeding the late Dr. Henry Colt as chief of staff on December 29, 1931.

He was a past president of Berkshire District Medical Society, surgeon for Boston & Albany Railroad, and a member of several national and state medical organizations. He was a member of the First Congregational Church of which his grandfather, Rev. Dr. John Todd, was minister for 31 years from 1842. He also was enrolled in the Yale Club of New York, Saturday Evening Club, Pittsfield Country Club, Sportmen's Club and Pittsfield Riding and Polo Club.

As a sure and accurate diagnostician, Dr. Paddock had gained wide recognition. He was a tireless worker and devoted his life

to his profession. No other Berkshire physician had so large a practice among Berkshire summer residents. With hundreds he was not only the family physician, but a warm personal friend.

DR. WILLIAM THORNDIKE

Dr. William Thorndike, born in Milwaukee on August 5, 1870, died on November 23, 1935, at Milwaukee, of chronic lymphatic leukemia.

He was the son of a pioneer Milwaukee physician. He was educated in the public schools of Milwaukee, Noble School of Boston and Harvard University Academic and Medical Departments, receiving from the latter his M. D. in 1895. His two years of hospital training were spent at the Boston City Hospital and at the Boston Lying-In Hospital after which he returned to Milwaukee and engaged in general practice.

Upon his return from post-graduate work in Vienna, he was appointed Assistant Medical Director of the Northwestern Mutual Life Insurance Company in 1903, which position he held up to the time of his death.

Kindly, modest and unassuming, Dr. Thorndike possessed the courage which kept him at his desk until the day before his death despite seventeen blood transfusions and the knowledge that his disease was incurable. His cheerful disposition, keen sense of humor, coöperative spirit were never failing marks of distinction.

He was a member of the American Medical Association, The Milwaukee County Medical Association, The Milwaukee Academy of Medicine, as well as this Association.

He was beloved and respected by all who knew him and his passing has left a void that cannot easily be filled.

DR. FRANK L. TRUITT

It is with deep regret that we report the death of Dr. Frank L. Truitt on August 13, 1936.

Dr. Truitt was born in 1881 in Noblesville, Indiana, where he received his early education. He graduated in Medicine from the Indiana Medical College, which is now the Department of Medicine

of Indiana University, and also from Rush Medical College, Chicago.

He entered the practice of medicine in Indianapolis in 1905. He served as Bacteriologist for the City Board of Health at one time and was surgeon for the L. E. and W. Railroad during his days of private practice.

He was elected Medical Director of Reserve Loan Life Insurance Company in 1914, and in 1934 he was also elected Secretary, which offices he filled until his death.

Dr. Truitt served in the Medical Corps of the United States Army during the World War and in after years took great interest in the affairs of the American Legion.

Dr. Truitt was a student of Life Insurance Medicine and was always present at the meetings of this Association, and the Medical Section of the American Life Convention, having served as Chairman of that body in 1921.

Dr. Truitt was a resolute physician; he had a fixed purpose, he was determined, he was constant, he was steady.

He was loyal to his friends and associates, of whom he leaves many to mourn his loss.

The Salutation, "Well done, thou good and faithful servant", is well deserved by Dr. Truitt.

DR. JOHN S. TURNER

Dr. John S. Turner was born February 16, 1866, at Americus, Ga., and died August 29, 1936, at his summer home in the Ozark Mountain Range, near Fayetteville, Ark.

Dr. Turner was the son of Green B. and Martha Scott Turner, and came to Texas with his parents at an early age, residing in Cleburne, Texas, for a number of years. He received his education in the common schools of Texas, Professor Long's Academy in Cleburne, Grandbury College and Louisville Medical College at Louisville, Ky. He was graduated with the degree of Doctor of Medicine in February, 1889.

Dr. Turner first practiced medicine in Stephenville, Texas, 1889-92, and later at Granbury, Texas, 1892-1897. From there

he went to San Antonio as Assistant State Superintendent of the Southwestern Insane Hospital, 1897-1900. From 1900 to 1907 he was superintendent of the North Texas Hospital for the Insane at Terrell, Texas. Dr. Turner founded the Arlington Heights Sanitarium at Ft. Worth, Texas, a private sanitarium for the treatment of mental and nervous diseases, in 1907, and was connected with it until 1909, at which time he came to Dallas to serve as Medical Director of the Southland Life Insurance Company, which position he held until the time of his death. In addition he continued his specialty of nervous and mental diseases, and for several years occupied the chair of mental and nervous diseases in the Southwestern Medical College and Baylor University Medical College.

Dr. Turner was a former president of the Kaufman County Medical Society, the Tri-State Medical Association, Texas State Medical Association, Dallas City Medical and Surgical Association, and the Texas Neurological Association. He was formerly a member of the Board of Councilors of the American Medico-psychological Association; the Board of Councilors of the Bureau of Scientific Temperance Investigation in World's W. C. T. U.; a member of the Board of Health of the City of Dallas for fifteen years; served as diagnostician for the City of Dallas in the meningitis epidemic in 1911; Neuro-psychiatric examiner and member of the Board of Medical Review for Camp Travis during the World War. At various times he served on the staffs of Baylor, St. Paul, Parkland and Methodist Hospitals in Dallas. He was a member of the Dallas County Medical Society, the State Medical Association and the American Medical Association.

Dr. Turner is survived by his wife, three daughters, one sister and three brothers.

DR. THOMAS H. WILLARD

Dr. Thomas H. Willard, former Medical Director of the Metropolitan Life Insurance Company, died on Saturday, January 25, 1936. Dr. Willard was appointed Chief Medical Examiner of the Metropolitan, in 1890, a time when life insurance was regarded with suspicion in many quarters and was the victim of harmful

competitive practices. He became a member of the recently organized Association of Life Insurance Medical Directors in 1893 and immediately took an active part in its affairs. In collaboration with those strong and able characters, who made up the membership of this Association in the early days, he contributed through his industry, sound judgment and high principle, to the establishment of life insurance on the high plane which it occupies today.

From the very beginning of his Metropolitan career, he was a strong advocate of improved underwriting rules. He sought to prescribe medical examinations for all risks, foreseeing the better claim experience which would result, as well as the valuable data that could be collated and used to place all underwriting upon a more scientific basis. Because of his interest in this phase of the work, he was made a member of the original Medico-Actuarial Mortality Investigation Committee and served on that Committee until his retirement on December 31, 1932. He was President of this Association during the years of 1909 and 1910, and was the last President to serve for two terms. For many years he was a member of the Insurance Record Committee, of the Nominating Committee, and was Chairman of the Committee on Public Health.

In Dr. Willard's death, the Association lost one of its pioneers, who will long be remembered as a devoted and conscientious member, who was direct, forceful and colorful in his advocacy and support of those principles which he believed were for the benefit of life insurance in all of its phases.

DR. HARRY PERCIVAL WOLEY

Dr. Harry Percival Woley, Assistant Medical Director, New York Life Insurance Company, attached to the Chicago Branch Office, passed to his reward on August 12th, 1936, following an operation for an attack of appendicitis.

Dr. Woley was born June 8, 1864, at Maquoketa, Iowa. When quite young his parents moved to Watertown, New York, where Dr. Woley was educated in the public schools and graduated from Watertown High School in 1883. In September, 1883, he entered Hamilton College, joined Delta Upsilon Fraternity, and graduated in 1887. In the fall of 1887 he entered the College of Physicians

and Surgeons, the Medical Department of Columbia University. In 1890 he graduated and the following fall received an appointment as interne on the staff of Charity Hospital on Blackwells Island. In 1893 he began to practice medicine in Chicago.

In August, 1895, he was appointed medical examiner for the New York Life Insurance Company and in February, 1906, he was appointed Assistant Medical Director, a position which he held until his death. On the anniversary of his 40th year of service in the Chicago Office, he was honored by a Testimonial Meeting and in recognition of his long and active service, he was presented with a beautifully bound book with letters of appreciation from all those with whom he worked. These letters came from all over the continent and bespoke the great joy and friendliness with which he was regarded by one and all who came in contact with him.

His wife, Mrs. Vida Woley, to whom he was married for many years, passed away in April, 1933. He had one daughter, Miss Vida Woley, who still lives in Chicago.

Dr. Woley was highly regarded by the Home Office Staff on account of his splendid record as an examiner and for his administrative ability, as well as for his staunch loyalty to the Company.

President Russell in the Chair.

DR. RUSSELL—This, as you know, is the forty-seventh annual meeting of our Association. I think we have reason to be proud of the part we have played in the last forty-seven years in the progress of the vast institution known as life insurance—the greatest bulwark of protection against financial depression and of security against unrest and discontent.

The forty-seven years of this Association have brought order to and changed the art of medicine, part of it at least, as far as we are concerned, into the realm of science, into facts that stand, as distinguished from the tentative, the theoretical, and the conflicting individual theories concerning almost every phase of our art.

It is not my intention to bore you with a resumé of our progress. However, there are many among us who can compare the hit-or-

miss methods followed in the early days, with their consequent loss of protection for the individual and loss for life insurance companies, with the scientific, accurate methods now in use. We can with reason, I repeat, be proud of our part in the upbuilding of life insurance.

I am proud of being President of this Association and highly value the honor you bestowed upon me last year in electing me to the Presidency. I recall that several years ago one of our retiring Presidents stated that the Presidency of the Association was no sinecure, but that no prospective President need hesitate about taking it; that the position meant plenty of work but that a new President would find himself aided by zealous and able lieutenants. The work of my year has been delightful for me because of the always ready, efficient and courteous help.

The work of this Association, this voluntary coöperation of professional men who are by nature, training and ideals independently individualistic, reaches into every quarter of this country. As members of this Association we are doing more individually than it would be possible for us to do as individual practicing physicians. It is therefore important that the quality of these meetings be kept at the highest standard.

We have not by any means solved all our problems. We still have a long way to go. It is our problem to change parts of the art of medicine to science, to demonstrable set facts, upon which we as life insurance men, and all physicians, can place reliance for definite and certain aid according to their specific application. We all learn from experience gained by personal observation or passed by oral or printed word. It is extremely gratifying that this Association has through its coöperation determined many an uncertain line, and time has already proved the results to be correct.

I am strongly of the opinion that as Association members and as individual medical directors we should do all we can to remove this misapprehension of the aim and function of a medical director that still exists to a certain extent, not only in the lay mind, but in the minds of the personnel of certain departments in the life insurance business.

Gentlemen, in my own behalf as a New York member and in behalf of the other New York members, I welcome you with great pleasure. I hope that you will enjoy your visit here, renewing personal friendships and making new ones. I also trust that your attendance at this meeting will prove profitable to you as individual physicians and as representatives of the companies you serve.

In the past years, as we all know, we have done much to further the aim and purpose of our Association, but we know that much is still to be accomplished. This meeting I am sure will bring us nearer accomplishment.

In formulating the program it has been the endeavor to present subjects of practical value and to cover some of the problems which have not been heretofore discussed in our meetings. You will therefore find on the program subjects which, it is hoped, will interest you. It is my sincere wish to have you enter freely into the discussions and to ask any questions that you may desire.

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At this time I wish to welcome Dr. P. Maxwell Foshay, Vice President and Manager of Selection of the Mutual Life Insurance Company of New York, whom many of you know. I am sure we shall all be glad to have Dr. Foshay make a few remarks.

Dr. Foshay—It is news to none of you that the chief causes of death of one generation are seldom those of the next. It follows that statistical studies of our past mortality, indispensable as they are, do not alone suffice to represent selection at its best. Ever there remains the *art* of selection just as in practice the art of treating the patient has been aided but never supplanted by the great advances in the science of medicine. There are no substitutes in applied science for brains, skill, training and experience. Hence the very real value of these "meetings". Here you add what you can to the interpretations of the accumulated experience of your companies—that is, you perfect the science of medical selection. But beyond that is the value of the free interchange of ideas about methods of selection which enable us to improve the technique, the art, of selection.

Some of you perhaps believe that the widely heralded "strain of modern life" accounts for the ills of our generation, particularly the numerical prominence of deaths from "heart disease"—the cardiorenalvascular category. I hope not. It is too easy an "out" from a real problem. Can we prove that in man's long ascent from the primitive there ever was a period in world history when man could command more comforts, more protection from physical and pathologic dangers? That would be a hard task if we "get down to cases". Sooner or later there will be enlightenment from scientific research.

A generation or so back the cardiovascular-renal group of diseases usually were, as you know, at death recorded as "old age". If they are really more frequent causes of death than previously and not just statistically more prominent, would that not perhaps indicate earlier "old age"? Can we who are engaged in life selection supply data that may help toward a solution? Is it possible that sclerosis and thrombosis are deficiency diseases? Instead of a hypothetical "strain" in life is there some little item of diet, or light, or whatnot that is missing? Is there any relation to the enormous increase in the consumption of tobacco? Probably not, but you might be able to accumulate definite facts. Can we determine whether there has been an increase in the prevalence of focal infections—sinusitis, apical dental infection, cholecystitis, etc.? That seems probable. Can we contribute our mite of facts? Pearl's study of heredity as affecting the incidence of cardiovascular disease which he presented before the Medical Section of the American Life Convention at its last meeting showed a strong presumption of hereditary predisposition of some sort.

Thus far our gropings for the causes of the degenerative diseases, the scleroses, remind us rather painfully of the anecdote at least two generations old in which the college student likened the study of metaphysics to a search for a black cat in a dark room where there was *no* cat.

Admittedly the topic is trite but these early death claims from cardiovascular disease plead justification for mention. Not one of us here, I surmise, has escaped painful shocks. Perhaps we are at the threshold of a period when the companies jointly can

undertake a careful study. The results might furnish new and helpful data to the clinicians who do not see the cases prior to occlusion, or decompensation, or congestive heart failure. Our cardiographic and X-ray records are antecedent and might serve the clinicians at least as the starting point for a new approach. How to collate the records and render them serviceable is in itself a task of magnitude to occupy a preliminary committee for some time.

I really believe that you should take the lead in such a research, not however until you have canvassed the possibilities. The problem is primarily and inherently medical. It is only statistical when it comes to assorting the collected material. One obvious preliminary difficulty has to do with the accuracy and sufficiency of the causes of death as assigned in our claims. Doubtless you have had the experience in special cases of securing a quite different impression after asking your examiner or the inspection service for fuller information. The old concept faces us, the indispensability of the real facts in each case.

The Association throughout its respectable years has achieved much solid work. With modern tools and organized effort it must be on the eve of greater accomplishments.

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Dr. Russell—On behalf of the Association, I want to extend a hearty welcome to the delegates of the American Life Convention;—to these gentlemen who have been selected to represent our sister organization—the Medical Section of the American Life Convention. I hope that they will feel perfectly free to enter into not only the business activities but also the general discussion of the various papers to be presented. No meeting of this Association would be complete without an official word from the Medical Section of the American Life Convention. So we are naturally pleased that Dr. Donald B. Cragin, Chairman of that Section and Medical Director of the Aetna Life Insurance Company, has consented to say a few words to us at this time.

Dr. Cragin—Mr. President and Members of the Association of Life Insurance Medical Directors of America: As Chairman of the Medical Section of the American Life Convention, I have the honor and pleasure of extending to you cordial greetings from that body. We appreciate the valuable work which the Association is doing in its medico-actuarial studies and the voice it has in directing medical underwriting today. In our organization we look to you for direction and try to make our programs supplement yours. Necessarily we have to lean more on the clinical side of the problems. I think those who have followed our programs through the Transactions will admit we have achieved a pretty fair measure of success and have received the benefit of the ideas of some of the most outstanding clinicians.

Our meeting, the first part of June next, is to be held at the Broadmoor, Colorado Springs. I can personally vouch for its being a most delightful spot, on the edge of the Rocky Mountains, at the foot of Pike's Peak, and in an exhilarating atmosphere with all the creature comforts—provision made for entertainment of families and guests, side trips in all directions to the haunts of nature, and a tricky golf course.

On behalf of the Medical Section of the American Life Convention, I extend to you who are not members an invitation to join us in our annual feast of intellect and flow of soul. We have a splendid program, just a little out of the ordinary, with nationally known readers and rapid-fire discussers. There is a plenty of room and a cordial welcome for you all.

Mr. President, I present to you and your organization the greetings and the good wishes of the Medical Section of the American Life Convention.

Dr. Russell—We now come to the scientific portion of our program. The first paper will be presented by Dr. Albert O. Jimenis and Dr. Edmund W. Wilson, Assistant Medical Directors of the Metropolitan Life Insurance Company. The subject is of unusual importance to each one of us. I am sure our very efficient Treasurer, Dr. Jimenis, and his worthy associate, Dr. Wilson, will have some very valuable information to give us.

INFLUENCE OF ELECTROCARDIOGRAM OR X-RAY ON UNDERWRITING DECISIONS

By Albert O. Jimenis, M. D., and Edmund W. Wilson, M. D.

Assistant Medical Directors, Metropolitan Life Insurance Company

You will recall that in 1931 Dr. Fellows reported on a study of 1,000 applicants who, in addition to having been examined in the Field, had had a thorough examination at our Home Office including an electrocardiogram or X-ray. He compared the final action in each case with the action we would have taken on the field examination alone.

We thought we would present a paper comparable to Dr. Fellows' study, but we find that he included the physical examination made by Home Office doctors with the X-ray and electrocardiogram, considering these three items together. We now wish to study the effect only of the electrocardiogram and X-ray of the thorax on our underwriting. Thus, in this study, the physical examination made at the Home Office is considered together with any field examination, history or record, and on these facts we have estimated what our "probable offer" would have been without the electrocardiogram and X-ray. We compared this "probable offer" with the actual offer made after the electrocardiogram and X-ray were taken, and thus assessed the influence of the electrocardiogram or X-ray on underwriting.

The group consists of 1,457 applicants for new insurance who received an electrocardiogram or X-ray or both between July, 1931, and December, 1932. We studied these early cases in the hope that we could report on the mortality also. This group is not comparable to our usual run of cases, including as it does only those who had one or both of these special examinations. A few had these special examinations in the Field, but practically all of them were examined at our Home Office.

Our Home Office rules for the use of these special examinations during this period were as follows:

An electrocardiogram was taken on applicants for $50,000 or more at age 35 or over, or for $25,000 or more at age 45 or over; and an X-ray and electrocardiogram were taken on all those applying for $100,000 or more at any age. These routine cases constituted about 10% of the group who received the special examinations.

An electrocardiogram was taken on all those who had an unfavorable heart or blood pressure finding. Beginning March, 1932, all those who received an electrocardiogram were also X-rayed.

Every applicant who was examined at the Home Office had a fluoroscopic examination of the thorax and any who showed abnormal or suspicious shadows or questionable heart enlargement were X-rayed. In addition, an X-ray examination was ordered because of general appearance, loss of weight, or because of some intangible reason such as lack of frankness in giving the history.

I think it is clear that this group is not representative of any other group in our files because of its peculiar selection.

In order to determine what our probable action would have been without the special examinations, Dr. Wilson or I reviewed each application, and without considering the X-ray or electrocardiogram we noted our decision or "probable offer." This "probable offer" was then compared with the final action which had been taken on the case after consideration of the special examinations.

We have divided these 1,457 cases into those who had the special examinations because of amount applied for and those who had them because of unfavorable physical findings, record or history.

Without the special examinations 66 of the 135 large policies would have been issued as applied for; but after the special examinations we find that one was limited to Ordinary* from Whole

*Mortality limit of our Whole Life and Term is 110%; other Ordinary 125%; Intermediate 150%; Special Classes 250%; Decline over 250%.

Life, one was limited to Intermediate, two were limited to Special Class, and 7 were declined; a total of 11 cases, therefore, received a heavier rating.

TABLE I.

Influence of Electrocardiogram and X-ray Findings on Underwriting Decisions. Electrocardiogram or X-ray Taken Because of Amounts Applied for. Applicants for New Insurance July, 1931—December, 1932

Metropolitan Life Insurance Company

"Probable Action" Without Electrocardiogram or X-ray Findings	Final Action					
	Total	Issued as Applied For	Limited from Whole Life or Term (Mortality Limit 110%) to Other Ordinary (Limit 125%)	Limited to Intermediate (Mortality Limit 150%)	Limited to Special Classes (Mortality Limit 250%)	Declined
Total	135	60	13	7	8	47
Would have issued as applied for	66	*55*	1	1	2	7
Would have limited to Ordinary (from Whole Life or Term)	14	2	*11*	—	—	1
Would have limited to Intermediate	13	3	—	*6*	1	3
Would have limited to Special Classes	9	—	—	—	*5*	4
Would have Declined	33	—	1	—	—	*32*

The figures in italics indicate those cases which would have received the same rating without the special tests as they actually received after the special tests.

The figures in heavy type to the right and above the italics indicate those cases which received a heavier rating with the special tests than they would have received without them.

The figures in light type to the left and below the italics indicate those cases which received a lighter rating with the special tests than they would have received without them.

Without the special examinations, 14 cases would have been limited to Ordinary from Whole Life; but after these examinations, two were issued Whole Life as applied for, 11 received an

equal rating, and one was declined; a total of two lighter ratings, 11 equal ratings and one heavier rating.

Among the 13 who would have been limited to Intermediate without the special examinations, three cases were given a lighter rating, six others were unchanged and four cases were given a heavier rating or rejected.

Among the nine applicants who would have been limited to Special Class, the special examinations failed to produce a single lighter rating and four cases were declined.

There were 33 who would have been rejected; the special examinations saved one who was given an Ordinary policy.

In the whole group of 135 large amounts the special examinations permitted us to offer a lighter rating in 6 cases and caused us to give a heavier rating in 20 cases.

The special examination was made on 1,322 applicants because of unfavorable record, history or physical findings; 377 of the applications would have been issued as applied for, but after the X-ray and/or electrocardiogram 332 were actually issued as applied for, two were limited to Ordinary from Whole Life, 11 were limited to Intermediate, six were limited to Special Class and 26 were declined.

Of the 1,322 applicants, we would have limited 120 to Ordinary insurance from Whole Life or Term without the special examinations, but after the special examinations we were able to issue Whole Life or Term to 21 of them. We made no change in our decision in 78 cases and rejected or gave a heavier rating to 21.

There were 218 applicants who would have been limited to Intermediate without the special examinations; of these, 40 were given a lighter rating and 137 received the same rating, 14 a heavier rating and 27 were declined.

Without the special examinations, 166 would have been limited to Special Class. After these examinations, 20 received a lighter rating, 110 an equal rating and 36 were declined.

A total of 441 would have been declined without the special examinations. In 25 of these cases, we were able to issue some form of insurance after the X-ray and/or electrocardiogram.

TABLE II.

Influence of Electrocardiogram and X-ray Findings on Underwriting Decisions. Electrocardiogram or X-ray Taken Because of Record, History or Physical Findings. Applicants for New Insurance July, 1931—December, 1932

Metropolitan Life Insurance Company

"Probable Action" Without Electrocardiogram or X-ray Findings	Final Action					
	Total	Issued as Applied For	Limited from Whole Life or Term (Mortality Limit 110%) to Other Ordinary (Limit 125%)	Limited to Intermediate (Mortality Limit 150%)	Limited to Special Classes (Mortality Limit 250%)	Declined
Total	1322	389	98	168	147	520
Would have issued as applied for	377	*332*	2	11	6	26
Would have limited to Ordinary (from Whole Life or Term)	120	21	*78*	4	2	15
Would have limited to Intermediate	218	27	13	*137*	14	27
Would have limited to Special Classes	166	5	3	12	*110*	36
Would have Declined	441	4	2	4	15	*416*

The figures in italics indicate those cases which would have received the same rating without the special tests as they actually received after the special tests.

The figures in heavy type to the right and above the italics indicate those cases which received a heavier rating with the special tests than they would have received without them.

The figures in light type to the left and below the italics indicate those cases which received a lighter rating with the special tests than they would have received without them.

In the group of 1,322 cases the special examinations permitted us to give a lighter rating to 106 and caused us to give a heavier rating to 143.

Combining the two groups, we find that as a result of the electrocardiogram or X-ray findings we declined 119 applications on which we would have issued some form of insurance; we issued 26 which we would have declined; we issued 86 with a lighter

rating and 44 with a heavier rating than we would have offered without the electrocardiogram or X-ray.

This difference is certainly not extraordinary when you consider the thorough search that these examinations make of the heart and lungs.

Since there were only 47 deaths in this group of 1,457 cases, the experience is still too small for us to say anything about mortality but there can be little doubt that our final decisions are in keeping with the actual conditions present.

In addition to the above facts, there are a few other items of interest which have been found in this study.

The same proportion of abnormal electrocardiograms (about 17%) occurred among persons having no history or physical findings of heart disease or high blood pressure as among persons who had such a history. However, among persons having no such history, 15% of the electrocardiograms were suspicious and among applicants having a positive history, 27% of the electrocardiograms were suspicious. Our electrocardiograms were considered abnormal or suspicious according to the Insurance Record definitions for coding.

We had X-ray films of 1,125 cases on which the heart could be measured. Of those with a negative history or physical examination of heart and blood pressure, 8% showed enlarged heart or aorta by X-ray; of those with a doubtful or positive history of heart or blood pressure, 18% showed an enlarged heart or aorta by X-ray. Our criterion for enlarged heart was the Hodges & Eyster table and an aorta of 7 cm. or more was considered abnormal.

An X-ray of the lungs was taken on 1,191 cases. Of those who had a negative history of lung disease, 10% showed definite evidence of a parenchymal lesion characteristic of tuberculosis by X-ray; of those who had a positive or suspected history of tuberculosis or hemoptysis, 43% were positive for tuberculosis by X-ray and 50% showed no tuberculosis by X-ray.

You remember the beginnings of our use of these special examinations and the cautious manner in which we have proceeded. We have learned a good deal and experience will teach us more. At

first, our knowledge of the electrocardiogram was obtained entirely from clinicians who had observed the longevity, or rather, lack of it, in their own patients. Of course, practically all of these patients came to the physicians and an electrocardiogram was made *because they had symptoms.* Few clinicians have had the opportunity to study electrocardiograms of an adequate number of presumably normal people. This group of applicants for insurance provides an opportunity to study the effect on longevity of many electrocardiographic findings which previously have been studied only on those who were ailing.

For this reason, it would not surprise us if in five or ten years we discover that we shall be able to issue substandard insurance in some cases which we now decline.

Nevertheless, the facts brought out by Mr. Samuel Milligan in his paper read at our 1931 meeting should restrain anyone who thinks he may be able to successfully underwrite large or questionable risks without the aid of these special examinations. These special laboratory tests are a protection to the Company and an assurance to the applicant of our wish to be fair.

DR. RUSSELL—I presume you have noted that the three discussers listed on the program are all members of the Committee on Electrocardiographic and X-ray Procedure. I understand, however, that in spite of this fact they still have enough difference of opinion to make their treatment of the subject more than interesting. The discussion will be opened by Dr. Harold F. Taylor, Associate Medical Director of the Aetna Life Insurance Company.

DR. TAYLOR—Following Dr. Fellows' report of 1931 we reviewed 500 files in which special examinations had been submitted and found that our underwriting experience had been similar to his: i. e., the favorable results viewed by the agent counterbalanced the adverse. Since that time we have assured our field force that they are getting the long breaks.

In the past year or two we have occasionally wondered if the picture was not possibly changing; but have never got to the point

of investigation. So I wish to thank Drs. Jimenis and Wilson for furnishing the urge to review again our files.

We have studied 1,200 applications received since January, 1932, in which electrocardiograms or X-rays of chest, or both, were submitted. No attempt was made to sub-divide into separate groups of X-ray and electrocardiogram. These 1,200 cases are unlike the Metropolitan series in that *none* of the special examinations were made under Home Office supervision and practically all of the physical examinations were made in the field. This combination has undoubtedly been conducive to errors in medical underwriting that would not occur where these factors were under Home Office control.

In the sub-grouping we have used the same divisions as in Dr. Jimenis' report. (1) Amount of insurance involved.—In the main we have followed the recommendations of the Committee on Jumbo risks. We feel that the Metropolitan is moving in the right direction in calling for special examinations where smaller amounts are involved. (2) History: personal, developed at the time of examination; or Insurance Record. (3) Physical findings: irregularities of rhythm or rate; questionable muscular tone, etc.

In many instances special examinations were made in the field, unsolicited by our Medical Board, in hopes of influencing some unfavorable action already taken. Of the 1,200 files reviewed, 143 were informal or trial applications, where the individual had received unfavorable consideration in some other company. This group was not included in the following figures. This left 1,057 cases on which medical action could be taken. Of this number the special examination had an adverse effect on the final issue in 218 instances. Total, 1,057; with 218 adverse, or 20%. In 41 instances we were able to give a more favorable action.

				Metropolitan
Total	1,057 with 41 better	3.6%		4.5%
1. Amount	398 with 73 adverse	18 %		15 %
2. History	456 with 118 adverse	26 %	22%	12 %
3. Physical	203 with 27 adverse	10 %		
	with 41 better rating	20 %		

Our first reaction on comparing our figures with those of Dr. Jimenis was one of concern. What was the answer? Are we re-

ceiving a poorer grade of business? Are we out of line in our interpretation of the evidence submitted? Granted that there may be some variation because of these items, it hardly accounts for 10% less favorable experience in the underwriting of risks with questionable history or physical findings.

I believe the explanation lies in comparison of the foundations of the two reports: i. e., the quality of the special reports considered in evidence. I can recall several instances of adverse action resulting where improperly standardized electrocardiograms or poorly taken X-rays were submitted. Such complications, of course, do not arise where this work is done in the Home Office. By the by, I feel that the character of the work submitted from the field is gradually improving and is definitely better than it was a few years ago. I cannot help but feel that our high insurance requirements have been in part responsible for this improvement.

The next question that comes to mind: What has caused this change in the past five years, from a situation where the preponderance of medical evidence gained by special examinations had a favorable effect on issue, to just the opposite picture? In our own Company two explanations come to mind. (1) Prior to five years ago very few of our large risks were subjected to these special studies. Now these tests are routine requirements. (2) We formerly gave more favorable consideration to cardiac arrhythmias proven by electrocardiogram to be premature systoles, regardless of age. Now we are limiting such credit to those under age 45.

Experience is definitely proving the value of these special studies as a protection to our companies. To date we have at least been conservative, perhaps over-conservative. I am anxiously looking forward to the time when all companies here represented will pool their experience. I believe we will find that we can liberalize our underwriting in many ways.

DR. RUSSELL—The discussion will be continued by Dr. Charles F. Nichols, of the Penn Mutual Life Insurance Company.

DR. NICHOLS—In the diagnosis of an impairment, the laboratory has come to be of inestimable aid in confirming or denying an

opinion. This is equally true of life insurance medicine, which should be most exacting in correctly evaluating the physical condition of applicants.

It is well known that life insurance medicine has focused the attention of clinicians upon the mortality and morbidity significance of various conditions and histories, (such as family history, blood pressure, albumin, sugar), and has given to electrocardiography an impetus which otherwise would have required many years to bring about. The medical staff of the Penn Mutual feels that there should be an even closer coöperation between various specialists and life insurance medical officers.

We are irresistibly forced to protect ourselves against the possibilities in modern advances in diagnostic medicine for selection against the Company. Special diagnostic studies are carried out routinely on many individuals who complain of only the most minor symptoms. Consciously or unconsciously many of these individuals may apply for insurance before their impairments attain a degree that will be detected by the routine insurance examination. This factor may develop as a very marked selection against the Company.

No one contends that diagnostic studies should be carried out on all applicants. That is neither practical nor necessary. However, in the large groups of impaired risks or those suspected of impairments or where personal histories cannot be adequately evaluated, they become imperative. Doctors Jimenis and Wilson have clearly pointed out the desirability of such studies on applicants for large amounts of insurance; in fact, they have shown the impossibility of otherwise successfully underwriting large risks. Without doubt, these studies will gradually be extended to applicants for smaller amounts of standard insurance, which certainly cannot help but lead to a more equitable selection of risks. This applies perhaps more to impaired lives, but not necessarily so, since it is the standard risk which usually fails to disclose his history of complaints and previous illnesses. More important perhaps than the equitable selection of risks is the better control of the mortality which will follow. Only a few large and heavily

impaired risks are enough to influence mortality adversely. The control of mortality is the final test of any method of selection.

If the volume of business justifies, the establishment of a diagnostic laboratory in the home office and the medical referee's office is essential. The initial expenditure and maintenance costs are not only justified, but highly necessary because of the actual broadening of selection and the savings to the Company. Rather than thinking of the diagnostic laboratory as an added expense to a life insurance company, it should be considered that the equipment and the personnel of a diagnostic laboratory constitute a distinct investment. At the present time at least ten companies have complete diagnostic equipment in their home offices, and, in addition, there are two medical referees' offices which are fully equipped for diagnostic work and five which are partially equipped for such work. The importance and necessity of fully equipped medical referees' offices will no doubt lead to a further increase in the number.

In the past, many companies included in their examination a question asking the opinion of the medical examiner as to the insurability of the applicant. It was thought that the home office could accept more or less the examiner's judgment. This period obtained before the medico-actuarial studies. Today, the judgment of the medical examiner, excepting in so far as his actual findings are concerned, is disregarded. We recognize the average competency of our field examiners in diagnosing impairments, but the meaning of these impairments in terms of mortality is a highly-specialized function of the home office medical department.

It becomes pertinent to inquire how the diagnostic laboratory and diagnostic studies in general may aid the field examiner, the home office, the field representative and the applicant himself. In addition to the diagnostic problem, there develops the even greater problem of carrying out the procedures in such a way as to give mutual satisfaction to the above groups, which are vitally involved in broadening the basis of selection and effecting savings in mortality.

Obviously, immediate and ultimate mortality is in direct relation to the efficiency of the medical examiner. It follows, there-

fore, that in any territory where a sufficient volume of business is produced, especially competent diagnosticians should be available.

From an agency standpoint, I have often heard the remark that agents, unless compelled, would not submit their applicants to examiners who are highly qualified as internists. Our experience has been to the contrary, particularly in Philadelphia, where we have a large home office agency. An applicant presented at the home office for examination is examined immediately. There is no period of waiting, even if an appointment has not previously been made for the examination. If an impairment is found by the examiner, a consultant is immediately called in; and if diagnostic studies are considered necessary, the reasons are explained to the applicant. Without exception in these cases, the applicants have proceeded with the studies indicated, if not at the time of the examination, then at a later date if time limitations at the moment prevented.

Because of this procedure, not only have we been able to broaden our selection, but we know that an improved mortality has resulted. We know, too, that the *modus operandi* is very pleasing to our agents because, while in 1931 thirty-three per cent. of the total number of applicants examined for this large home office agency were examined in the home office, in 1935 the percentage had increased to forty-one per cent. This does not include those cases originally examined outside the home office and later referred for some special diagnostic details. Naturally, this would not be possible without the coöperation of our agents.

Another advantage which we feel we are achieving through the services of our diagnostic laboratory is the coöoperation and good will of applicants examined there, who almost without exception cause reports of our findings to be forwarded to their personal physicians. Thus, indirectly, we are also contributing in some small measure to the cause of health conservation by stimulating these individuals to seek professional advice and to have physical reviews from time to time.

In comparing diagnostic studies from individual and widely separated laboratories, it is natural that there should be some variability in the results, even when the statistical analysis is to a

large extent the same. There are several reasons for this: namely, variability in interpretative methods; differences in underwriting procedures; and, perhaps most important, the varying classes and degree of impairments which are presented.

In analyzing our laboratory results, we have followed much the same method set forth in Drs. Jimenis' and Wilson's paper. We have attempted to evaluate the applicant on the basis of the field examination and his history or record, and from this data to arrive at a tentative action, which has then been compared with the final action as influenced by the diagnostic studies.

We have not attempted to isolate the purely mechanical diagnostic studies and evaluate their influence in each individual risk. In many cases, we have incorporated the mechanical diagnostic studies with the opinion of the clinical expert who examines the risk at the home office, it being our opinion that this is the most desirable method to follow. The home office diagnostician, being well trained in clinical diagnosis, thus acts somewhat as a liaison officer between life insurance medicine and clinical medicine. This cannot help but serve the best interests of all concerned.

In considering our laboratory, the difference in results no doubt can be accounted for somewhat by the strata of society from which our applicants come. Probably 80% of our diagnostic work arises directly out of our large home office agency. This home office agency comprises approximately 300 full-time agents, many of whom have been in the service of the Company for years. They represent an excellent type of highly trained field representative and through years of work have built up a high-grade clientele. The remainder of our diagnostic work consists of miscellaneous cases arising in the neighboring states.

During the last two years, our diagnostic laboratory in New York City, of which Ernest F. Kerby, M. D., is director, has had a constantly increasing volume of work. This also is incorporated in our final analysis, receiving the same evaluation as the studies completed in our home office laboratory.

We conceive that the main function of the diagnostic laboratory is to broaden the basis of selection through the application of modern procedures. Up to the present time these procedures have

been applied particularly to two classes of impairments, those of the respiratory and cardiovascular systems, although we do a reasonable amount of gall-bladder, gastro-intestinal, genito-urinary and bone work.

The following report and summary are based upon the study of 1,086 applicants for insurance upon whom an X-ray or electrocardiogram or both were taken. The reasons for this study, which you will notice is based to a large extent upon respiratory and cardiovascular system conditions, are set forth in some detail. The results are uniform, in so far as they represent the conclusions and opinions of a single individual.

It still remains a fairly prevalent belief, especially among the field force, that such studies tend to increase the number of applicants who are rated or declined. By our laboratory analyses, we have definitely proved it to be untrue.

In general, our studies have been carried out largely on applicants applying for large amounts of insurance; but, in addition, we have studied applicants with histories of heart or lung symptoms or records of such impairments, also applicants who are dissatisfied with the original action as based on the field examination. It is conceded, therefore, that this group, a large percentage of which are impaired individuals or believed to be impaired, is not representative of the body of applicants as a whole, constituting a most severe test of the methods in question.

The appended summary of this group of cases shows that our studies have been more often in favor of the applicant than otherwise. This is as it should be, because the more carefully you examine an individual the more accurately you will be able to determine his insurability. Certainly a profitable business could be produced on declined applicants if they were fairly evaluated from a diagnostic standpoint. This is the function, we wish to constantly stress, that the diagnostic laboratory plays in the conservation of business. Protection of our mortality from early deaths goes hand in hand with this conservation of business. The fact that the results indicated in the attached summary differ from the laboratory results of some other life insurance companies must

CASES STUDIED IN THE DIAGNOSTIC LABORATORY
1934 and 1935

Diagnostic studies were carried out on a total of 1,086 cases in 1934 and 1935. The reasons for the studies were:

Big case requirements	124			
Lung history; lung findings; underweight; confidential information regarding lungs; family history of lung trouble	262			
Hypertrophy of heart reported by our examiner or through confidential sources	96			
Heart findings; confidential information relating to the heart or past history of heart trouble; high blood pressure	604			
	1,086 cases			
Standard:				
Applicants who would have been granted standard insurance without diagnostic studies	27	(3%)		
Applicants given standard insurance following diagnostic studies who otherwise would have been rated or declined	415	(38%)	442	(41%)
Rated:				
Applicants given higher ratings following the diagnostic studies	26	(2%)		
Applicants whose ratings were unchanged by the diagnostic studies	54	(5%)		
Applicants given lower ratings following the diagnostic studies; or whom we rated, whereas without studies we would have declined	209	(20%)	289	(27%)
Declined:				
Applicants not granted insurance for non-medical reasons or because cases incomplete, who otherwise had satisfactory laboratory findings	104	(9%)		
We declined as a result of studies, would have granted standard or rated policies otherwise	33	(3%)		
We declined as a result of medical findings and would have done so without the studies	218	(20%)	355	(32%)
			1,086	(100%)

be attributed in a large measure to the degree of the impairment which comes under observation.

Our electrocardiograms have been interpreted largely in conformity with the Medical Directors Association's definitions for coding. In some instances, we have varied somewhat from this rule, but not seriously. For example, we do not believe all Q waves in Lead III are necessarily abnormal. They may occur in the normal heart. It is not advisable to attempt to extract from the electrocardiogram information which it is incapable of giving. Until statistical studies approach the realm of certainty and can be correlated with definite mortality trends, we must be careful not to attach too much seriousness to certain apparent minor variations from the normal which are still questionable and which have not been brought beyond the stage of assumption. This viewpoint has been exceptionally well stated by a competent observer, whom I shall quote:—

> "There is great danger in interpreting an electrocardiogram without full knowledge of all the other clinical features of the case. The evidence furnished by the electrocardiogram can be properly evaluated only when all evidence is in, otherwise it will often deceive us. It always tells the truth but never the whole truth. Now that this instrument of precision is becoming an everyday office accessory of the internist, it may be hoped that it will lose some of the aura of infallibility which hung about it in its laboratory days. It may then assume its rightful position, not as a court of last appeal in cardiac diagnosis, but as a very valuable adjunct to physical and roentgen-ray examinations."

It is to be regretted that life insurance companies still permit field representatives to obtain electrocardiograms on their applicants on their own volition and to furnish them with various, not to mention heterogeneous, interpretations as evidence of a normal heart, notwithstanding that many of these individuals have hypertension, cardiac valvular disease, etc. This is a form of persecution to which life insurance medical directors should not be subjected. Post-graduate schools throughout the country are turning out after a six weeks' course large numbers of men who pass as expert cardiologists. Something more is required of an electro-

cardiographer than a slight knowledge of electricity, and that "something" is a broad knowledge of the normal and abnormal morphology of the organ he is attempting to evaluate. A book and an electrocardiograph make a dangerous combination—a "deathly" one for a life insurance company. The number of electrocardiographs in use in the United States is now well in excess of 3,000 and is rapidly increasing. This fact alone should be of significance to life insurance medicine, since it presents many adverse possibilities—particularly, the routine use of the electrocardiograph on many so-called normal individuals, and the fact that it may be used for preliminary studies previous to insurance examinations. Many misuses of the electrocardiograph could be obviated to a large extent if all medical examination forms contained a question directly of the applicant as to whether he has ever had an X-ray of any part of his body, ever had an electrocardiogram made, or any special laboratory studies performed.

We need, and life insurance medicine should soon be in a position to furnish, mortality statistics on so-called normal individuals and only slightly weighted with bad risks. Life insurance companies who are doing a fair volume of electrocardiograms on presumably normal people should soon group their findings and analyze the effects on longevity at all age groups of both the obvious electrocardiographic abnormalities and those which are still of questionable significance.

The Electrocardiographic and X-ray Committee is coding electrocardiographic findings in a uniform manner and will soon be in a position to group a large mass of statistical material. We hope that other companies will furnish us with statistics on their electrocardiographic findings.

In our evaluation of heart size, we have used the Hodges-Eyster table, but have also been influenced by the contour changes and by our own volumetric determinations. We have not adhered absolutely to the 7 centimeter rule for the width of the aorta, since this does not measure the aorta and since this width varies tremendously with the varying spatial relations of the thoracic cage. In this respect, our deductions may be somewhat different, since we feel

that we cannot adhere too closely to mathematical measurements in borderline conditions.

It might be interesting to note some of the types of cases which have been reviewed in our home office laboratory. Every year a fairly large number of applicants are presented in whom the field examiner has noted cardiac hypertrophy, slight to moderate. In most of these cases, there are no etiological factors disclosed. In our review of them, we have found that as a group they are tall, thin-chested individuals, with their hearts close to the anterior chest wall. The obvious, easily palpable apex has led to a wrong interpretation. Invariably, chest X-rays have proven that these individuals have small, centrally-placed hearts.

There also appear each year a reasonably large number of cases referred by the field examiners, usually young individuals, in whom a diagnosis of slight heart enlargement or some heart impairment is attributed to strenuous athletic activities. Since we believe that the burden imposed by physiologic acts upon the normal heart does not injure the heart muscle fibres, does not produce injurious dilatation and does not exhaust the heart reserve or produce heart disease, a home office review of this group of risks has uniformly been most favorable.

Many underweight individuals are recommended for insurance by the field examiners but subject to X-rays of the chest, basing their suggestions for an X-ray upon underweight only. It is only rarely that this type of examination reveals any abnormality.

Aortic stenosis is another frequent field diagnosis, and in a rather large group of such cases I have been able to confirm the diagnosis in only one instance.

Congenital pulmonary stenosis is also another group which offers difficulty to the field examiner. I have as yet failed to confirm any such diagnosis. The pulmonic physiologic murmur is usually misinterpreted.

In the past, many individuals have been sent away for rest cures because of suspected lung trouble, although this has never been proved by exact diagnostic studies. Our review of this group has also been extremely favorable.

Our treatment of heart murmurs conforms largely to that of all other companies. With the exception of the physiologic systolic murmurs originating over the pulmonary area and the cardio-respiratory murmurs, we feel that all other murmurs in adults merit serious consideration and are so treated. The evaluation of this group is much easier when diagnostic studies have been carried out.

This is also true of individuals with cardiac arrhythmias. The absence of hypertrophy and heart murmurs makes the appraisal much easier; and, while we do place some significance upon the frequency of the irregularity, there is as yet no decisive proof of any connection between the frequency of irregularity and the degree of impairment. In properly classifying arrhythmias, we must consider features that are not apparent in the pulse at all, but are brought out by electrocardiographic studies and X-rays of the heart.

Many of the applicants from the field receive ratings for tachycardia. In our home office review of this group, which rules out obvious causes for tachycardia in the thyroid, lungs and heart, we find that a large percentage of them are nervous tachycardias or belong to the group that has been designated as neurocirculatory asthenias (whatever that may be). Ten-year follow-ups on groups of so-called neurocirculatory asthenias have shown an even lower mortality than the general run of population, and our findings lead us to believe that nervous tachycardia has a mortality rate, if anything, little above normal. Our final evaluation of this group is usually more favorable than the evaluation based upon the field examination.

In our evaluation of arrested or healed pulmonary tuberculous lesions, we follow fairly closely the criteria set forth by Dr. Fellows before this Association at its meeting in 1934. In many instances, however, it seems that our treatment of this group has been even somewhat more stringent than that advised by Dr. Fellows.

The question naturally arises—what is the mortality on laboratory-studied cases as compared with the Company's mortality as a whole for the same exposure? We had planned to study our cases

after a five-year exposure, but in order to have some concrete evidence to offer have attempted a partial study of the mortality trend on laboratory-studied cases. Our home office laboratory has been in operation five years, but for at least a year and a half previously, possibly longer, our medical department received diagnostic studies from competent clinicians in the Philadelphia area.

We have been able to complete a follow-up on 2,000 cases. The exposure varies from one year to slightly over six years. We have not attempted to break the group up into age units or to narrow the exposure period by years, since this would serve no very useful purpose. Approximately thirty-five per cent. of this group represent substandard issues. In this group of 2,000 individuals who accepted their policies as issued and which were in force at the time of this study, there have been ten deaths, from causes as follows: 3, Lobar pneumonia; 2, Suicide—both carbon monoxide; 1, Acute alcoholism; 1, Cancer of tongue; 1, Meningitis, meningococcus; 2, Heart disease; Total, 10. Of these ten deaths, excepting two because of heart disease, all can roughly be classified as accidental and do not involve any questions as to the laboratory studies.

The two deaths from heart disease require brief mention. On the one individual, an electrocardiogram which had been made in 1930 was offered as evidence of insurability. It was normal. When application was made to our Company in 1932, we asked for another electrocardiogram, which was made in New York City and reported normal. The individual died two years later of heart disease, and in reviewing the two electrocardiograms, taken two years apart, it was at once noted that there appeared a distinct variation in the tracings, found only in the second lead, consisting of a definitely diphasic RT transition. These peculiar RT transitions have for a long time amounted to almost an obsession with me, since I feel they are of extreme diagnostic importance and are often the only and earliest electrocardiographic evidence of heart disease. The only explanation in this particular case is that I must have viewed the two tracings through rose-tinted glasses. This brings up a point I wish to emphasize; that is, the great significance of a variability in the electrocardiographic pattern on suc-

cessive tracings. The normal individual maintains relatively the same identical electrocardiographic pattern for years. When it changes, always suspect pathology.

The other death from heart disease does not reflect upon the laboratory. This applicant was insured at the age of forty years. His father and mother were living, in the seventies, and there had been no deaths in his family. There was no medical history, and all the diagnostic studies and the physical examination were entirely normal. He died three years later. In the intervening three years, he had received no medical attention and apparently had been in normal health. He was an intensely hard-working lawyer. One evening, he went to his home in the suburbs from his office, had his dinner in the usual manner, then walked into the living room to read the paper—and died immediately. By immediately, I mean within five minutes. Autopsy revealed extensive coronary artery disease, so extensive that there was a partial stenosis in several of the coronary vessels. There, however, were no coronary thrombosis and no infarction. This death can best be described as resulting from acute temporary coronary insufficiency. Coronary sclerosis with its inevitable accompanying fibrosis means a labile myocardium which may fail suddenly. Failure is precipitated by any factor that increases cardiac work. The most frequent factors are physical exertion, mental excitement, ingestion of food or any combination of these. This is a class of mortality that we shall continue to experience. The mechanism of death is either cardiac standstill or, more probably, ventricular fibrillation. This is a type of case in which the laboratory gives little information, our present methods apparently being incapable of disclosing it, and yet it is the kind of case in which information is most needed. In this instance, there is no doubt that at sometime in the intervening three years the electrocardiogram would have been abnormal, although there is no certainty of this because in at least thirty per cent. of individuals with coronary artery disease of this degree, unless subjective symptoms are disclosed, a diagnosis cannot be made by any of our present laboratory or clinical methods.

This partial, inadequate study of cases which have been studied in the diagnostic laboratory would indicate a very favorable mor-

tality trend; in fact, a surprisingly low one. Granting that the exposure is inadequate, still, if we were to consider these 2,000 cases on the basis of one year's exposure, we should yet have a surprisingly small mortality, especially when compared with the first-year mortality of many companies on their general business. It should be noted that many of these applicants actually had an exposure up to six years. We feel that, in order to have a favorable ultimate mortality, there must be a favorable immediate mortality. The trend of these 2,000 cases would indicate a very favorable ultimate mortality. We must, however, avoid drawing conclusions from the mortality rate in such a limited number of cases and with so short an exposure factor. Further studies and longer exposure will undoubtedly modify our present opinion, but the results so far as we have gone do indicate the usefulness of meticulous study in certain classes of risks.

Our study of mortality in declined cases is far from complete. This is also a slow process. In our partial attempt at this, we have found the mortality considerably higher than on our laboratory selected group. We have proceeded far enough to discover that declinations made on electrocardiograms alone or in conjunction with diagnostic studies have saved the Company many hundred thousands of dollars. This saving alone, which has been attained in a few years, would pay the operating expenses of several diagnostic laboratories for years to come.

It has been stated that, "Every life has an insurable value, and life insurance must constantly strive to arrive at the point where as many as possible who desire to be insured may be able to procure insurance." We do not subscribe wholeheartedly to this statement, since we feel there are many individuals who are so impaired that their mortality loadings when translated into dollars and cents make insurance utterly impracticable and impossible. In what degree this ideal is ever achieved rests entirely with the willingness of the companies to extend their diagnostic studies to certain definite groups of applicants. Such studies in no way conflict with the principle of group-prognosis upon which life insurance medicine operates. Even in group-prognosis, the principles and experiences of careful diagnostic studies are naturally decisive. They

cannot help but lead to new and better differentiated groups of similar pathological conditions.

Naturally, we cannot take from a disease-group the relatively more favorable risks and treat them separately. To do so only penalizes the remaining individuals of that group. Neither is it advisable to differentiate the individual groups to too great an extent and to split them up, for the basis of every statistical mathematical computation is the law of large figures. However, the scheme of group-prognosis must be flexible, as obtains in any true science; and carefully carried out, correlated diagnostic studies should lead the way to even better group-prognosis.

Life insurance medicine should always strive to make use of the advances and experiences of careful diagnostic clinical medicine. It will prevent the inclusion in special groups of heavily impaired risks and inevitably broaden the basis of conservative selection.

DR. RUSSELL—Dr. Harry E. Ungerleider, Assistant Medical Director of the Equitable Life Assurance Society, will continue the discussion.

DR. UNGERLEIDER—It is somewhat difficult for me to discuss this paper of Drs. Jimenis and Wilson on the "Influence of Electrocardiogram or X-ray on Underwriting Decisions" because of certain factors involved. Perhaps if we will go back to 1930 or thereabouts when the electrocardiograph and X-ray were made a part of the insurance examination and look at the scene in retrospect we can better evaluate the situation.

Here were two new media, both instruments of precision, added to the maze of medical selection. In truth, they were only two additional tools in the clinical physician's diagnostic kit, but in life insurance medicine for a time they were hailed as the answer to a maiden's prayer. The problem was to keep the dog's tail from wagging the dog, to delegate these two media to their proper place in the scheme of life insurance selection.

Naturally, being instruments of precision, their inclusion in the medical examination narrowed the meshes of the sieve of selection just as the urinalyses, blood pressure and blood-sugar determinations did when they were first introduced. There were

declinations at first and plenty of them for two reasons: (1) Every agent who had a heart or lung case, declined or very heavily rated, asked for and received permission, in my Company at least, to have his applicant re-examined in the Diagnostic Laboratory. Naturally, no amount of diagnostic instrumentation or skill can make a sick man well, or a non-insurable man insurable. (2) A good many of our early decisions were founded on our clinical experience, which, of course, was derived in the main from patients. However, it was soon apparent that consciously or unconsciously, our decisions were not made solely or in a great part on the electrocardiogram or the X-ray; that our final decision included the "tout ensemble" of the examination and that undue stress was not placed on any one element.

Consequently, I will not speak on the "Influence of the Electrocardiogram or X-ray (alone) on Underwriting Decisions." Rather my remarks should be considered an extension of those made by Dr. Fellows in Hartford in 1931 and should rightfully be called "The Influence of Physical Examination, Electrocardiogram and X-ray on Selection." I have not, as Dr. Jimenis and Dr. Wilson have done, gone over my cases to see what the probable offer without the electrocardiogram and X-ray would have been and what they were after their inclusion. I say, candidly, I am not in sympathy with that method of analysis. You will note that their paper deals with applicants who applied for insurance between July, 1931, and December, 1932. This is a particularly good period to have under observation for the following reasons: (1) Enthusiasm for this type of examination was then at its height. (2) We were having our growing pains in trying to delegate these new diagnostic media to their correct place in medical selection. (3) We were probably in the greatest era of anti-selection against the companies of the insurance business. Most people, who had at that time any money left were trying frantically to conserve their estates at the 1929 level. Agency departments were stimulating their agents to sell "shrinkage" insurance and we were overwhelmed with applications from those who previously knew they were uninsurable, but who now because of their losses made application in the hope that insurance would be granted. Again the insurance industry

was the only safe haven for funds and many denied their previous medical history in order to be able to profit by this circumstance.

However, I am giving below the results of 1,327 examinations for new insurance made in the Diagnostic Laboratory at the Home Office, including a physical examination, electrocardiogram and X-ray; and of 501 physical examinations with X-ray alone, in a period comparable to that reported by Dr. Jimenis and Dr. Wilson; namely, April, 1931, to April, 1932. These were made because of a previous record, a history on examination or physical findings and some because of the amount applied for.

It will be observed that 336 of all cases examined in the laboratory, or 20%, were declined originally; that is, insurance was refused on the examination by the regular appointed examiner, but an opportunity was afforded for the applicant to come to the Home Office for an examination if either he or his agent requested it. Of the remaining 80%, no declination was made and no action

EXAMINATIONS IN THE HOME OFFICE

Heart Cases (1,327 examinations for new insurance)

	No.	% of Total	Amount	Average Amount
Accepted				
Standard	210	15.8	8,590,083	40,905
Substandard	303	22.9	5,502,289	18,159
Declined for reasons other than heart (Diagnostic Laboratory satisfactory)	52	3.9	3,890,500	74,817
	565	42.6	17,982,872	
Declined				
Heart Impairment	512	38.6	16,091,850	31,429
Incomplete (did not return to complete examination)	7	.5	117,000	
			16,208,850	
Reconsiderations of original declined	243	18.3	(Not available)	
	762	57.4		

(Comparison of amounts involves an error not apparent, since declined are for the amounts *applied for*, while the accepted may be, and probably are, for a restricted amount. The average-amount figures show a marked variation under the different headings.)

Chest Cases (501 examinations for new insurance)

	No.	% of Total	Amount	Average Amount
Accepted				
Standard	70	14.0	796,588	11,380
Substandard	169	33.7	1,705,000	10,089
	239	47.7	2,501,588	11,291
Declined	134	26.7	1,513,000	
Incomplete	5	1.0	20,000	
Reconsideration	123	24.6	(Not available)	
	262	52.3		

All Cases Combined

Accepted				
Standard	280	15.3	9,386,671	
Substandard	472	25.8	7,207,289	
Declined for reasons other than heart	52	2.9	3,890,500	
	804	44.0	20,484,460	
Declined	646	35.3	17,604,850	
Incomplete	12	.7	137,000	
			17,741,850	
Reconsiderations of original declined	366	20.0	(Not available)	
	1,024	56.0		

taken until the applicant called at the Home Office for further examination. Of these, 55% were issued insurance and of the cases accepted, 37% were issued standard for $9,386,671 and 62% were issued substandard for $7,207,289. About 1% were declined for reasons other than heart and lungs for an amount of $3,890,500. However, a comparison of these figures with those shown by Dr. Jimenis and Dr. Wilson will show that the final underwriting decisions, on the whole, closely approximate one another.

In closing I want to emphasize again the fact that Dr. Jimenis' and Dr. Wilson's figures are for cases who applied from July, 1931, to December, 1932, and mine are for the year April, 1931, to April, 1932. The same ratio does not exist today. In 1931 our

ratio of accepted cases to declined, excluding the "reconsideration of original declined" group, was 5:4 while in the year 1935 it was 7:2.

DR. RUSSELL—I will ask Dr. Jimenis to close the discussion.

DR. JIMENIS—I want to thank the three discussers, Drs. Taylor, Nichols and Ungerleider. Frankly, I am relieved to find that Dr. Taylor and Dr. Ungerleider found approximately the same results in so far as the effect of the electrocardiogram and X-ray is concerned. I was fearful that perhaps there was some reason in our office why we were being too hard on these cases. Dr. Nichols, I know, has had somewhat different results. It is a little difficult, unless you set up your comparison in an identical fashion all the way through, to compare these results. I am sure there is a very good reason for the difference in our findings.

Dr. Nichols' suggestion of inserting a question regarding prior electrocardiograms and X-rays on our blanks is worth thinking about, and I know that at least one company uses such a question now.

I suppose we are interested in this question at least partially from the point of view of the local field force. We hope that the result is not too unfavorable to them. However, I am sure that none of us would hesitate to invite an applicant to be thus examined for fear that it might result in a heavier rating. We invite them because there is a good reason for it: either the amount applied for or some unfavorable factor already discovered. Furthermore, our local agents cannot charge that they alone are hampered in this manner, for we can and do ask for these examinations throughout the country and Canada.

Our list of special examiners prepared by the Committee on Electrocardiographic and X-ray Procedure is being kept up to date and continually enlarged, and I am told that it is being used more frequently each year.

DR. RUSSELL—I am sure that we are all indebted to Drs. Jimenis and Wilson and to the gentlemen who have discussed this paper.

DR. RUSSELL—The next two papers should satisfy the mathematical yearnings of any of our medical directors. The first paper is by one who needs no introduction. Dr. Charles P. Clark is a genius. His former studies have been of incalculable value to the insurance profession. This presentation is also destined to rank with any work that he has so far pursued. It deserves the deep and concentrated study of all of us. I take great pleasure in calling upon our very good friend whose helpful suggestions, incidentally, have added greatly in rounding out this year's program. I take this opportunity of thanking him.

A STUDY OF MORTALITY FROM BUILD USING THE INDEX $\frac{w}{h^2}$ AS AN AID

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For many decades, if not for centuries, build has been recognized as an important predisposing factor in the incidence of certain diseases. The effect of build on mortality rates has been stressed by Life Insurance actuaries and medical underwriters, particularly since the year 1912, when the Association of Life Insurance Medical Directors and the Actuarial Association of America published the report of an investigation into the relationship between build and mortality. This investigation, which was based on material offered by forty-three companies, clearly demonstrated that marked overweight, at all ages, is attended by an increased mortality; that underweight at younger ages is unfavorable, but at older ages, within the range of the available material, a favorable factor. Excessive height at younger ages is also attended by an increased mortality, but at older ages, among underweights, slightly over average height appears to be an asset.

In a previous paper, (1935), we presented a study of tables of height and weight, in which we used, as a guide, the index of build, $\frac{w}{h^2}$, recommended by Dr. Charles B. Davenport of the Carnegie Foundation, in a paper entitled, "The Best Index of Build", (Quarterly Publication of the American Statistical Association—No. 131, Vol. XVII, Sept., 1920). We demonstrated the value of this index in smoothing out tables of weight from rough data secured on homogeneous groups. We believe that the following study indicates the value of this build index in the analysis of mortality trends insofar as the effect of build is concerned.

In 1917, a Special Committee of Actuaries was appointed for the purpose of developing smoothed tables based on the rough data, developed in the investigation of 1912 above mentioned, and illus-

TABLE I-A

Short Men (Under 5′ 7″)

Age Group	Pounds Under or Over Normal Weight																						
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20-24	114	109	105	101	98	95	93	92	91	90	90	91	94	98	102	107	112	118	125	133	140	148	157	166
25-29	109	104	101	99	97	95	94	94	93	94	95	98	102	107	113	119	125	132	140	148	156	164	172	180
30-34	104	101	98	97	96	96	95	94	94	96	99	103	109	115	121	127	135	143	151	159	167	177	187	196
35-39	100	98	96	95	95	95	95	95	95	97	102	107	113	119	126	133	141	149	157	167	177	186	196	205
40-44	97	95	94	94	94	95	95	95	96	99	104	109	115	122	130	138	146	154	163	172	181	190	200	209
45-49	95	94	93	94	94	94	94	95	96	99	104	110	116	122	129	137	145	153	161	170	179	188	197	206
50-53	94	93	93	94	94	94	95	95	97	100	105	110	115	121	128	135	143	150	158	165	173	181	189	198
54-56	95	95	95	95	95	95	95	96	98	101	105	110	115	121	128	135	143	149	157	164	171	178	186	193
57-59	97	97	97	96	96	96	96	97	99	102	106	110	115	121	127	134	141	148	155	162	168	175	182	189
60-62	100	99	99	98	98	98	99	100	101	103	106	110	115	121	127	134	140	146	152	158	165	172	179	186

TABLE I-B

Men of Medium Height (5′ 7″ to 5′ 10″)

Age Group	Pounds Under or Over Normal Weight																							
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20-24	131	124	118	113	109	105	102	99	97	95	94	95	98	101	105	110	115	121	127	133	140	149	158	167
25-29	120	115	111	107	104	102	100	98	97	96	97	99	102	107	113	119	124	130	137	145	153	161	169	178
30-34	112	108	105	103	102	100	98	97	96	96	98	101	106	112	118	124	130	137	144	152	161	171	181	191
35-39	104	102	100	99	98	97	96	95	95	96	99	103	108	114	120	127	134	142	150	159	168	177	187	197
40-44	98	97	96	95	95	95	94	94	94	95	99	104	110	116	123	129	137	145	154	163	172	181	191	201
45-49	94	93	93	93	93	93	92	93	93	95	99	104	109	115	122	129	137	145	153	162	171	180	190	199
50-53	92	91	91	91	91	91	91	92	93	95	99	103	109	115	121	127	134	142	150	158	166	173	182	192
54-56	90	90	90	90	90	90	90	91	92	94	98	103	109	115	120	126	133	140	148	156	163	170	178	187
57-59	89	89	89	89	89	89	90	91	92	94	98	102	107	113	119	125	132	139	146	153	160	167	175	184
60-62	88	88	88	88	88	88	89	90	92	94	97	101	106	112	118	124	130	137	144	151	157	164	173	183

TABLE I-C

Tall Men (Over 5′ 10″)

Age Group	Pounds Under or Over Normal Weight																							
	−40	−35	−30	−25	−20	−15	−10	−5	0	+5	+10	+15	+20	+25	+30	+35	+40	+45	+50	+55	+60	+65	+70	+75
20-24	139	133	128	124	120	116	112	110	109	109	108	109	111	115	119	123	128	134	140	146	153	160	168	176
25-29	126	122	118	115	112	109	108	107	106	107	108	110	114	118	123	130	136	142	148	155	162	170	178	186
30-34	114	111	109	107	106	105	104	104	103	105	107	110	115	121	128	135	141	149	156	163	171	179	188	198
35-39	106	104	103	102	102	101	101	101	101	103	106	111	116	122	129	136	144	152	160	169	177	186	195	204
40-44	99	98	98	98	98	98	98	99	99	101	105	110	116	123	131	139	147	155	163	171	180	189	198	207
45-49	93	93	94	94	95	95	96	97	98	101	105	110	115	122	129	136	143	151	159	167	176	185	193	202
50-53	90	90	91	92	92	93	94	95	97	100	104	109	114	120	126	133	140	147	155	162	170	178	187	195
54-56	88	88	89	90	90	91	92	94	96	99	103	108	113	118	124	130	137	144	151	159	166	174	182	189
57-59	86	86	87	88	89	90	91	93	95	98	102	106	111	116	122	128	134	141	148	156	163	170	177	185
60-62	85	85	86	87	88	89	90	92	94	97	100	104	109	114	120	126	133	139	146	153	160	167	174	182

trating the effect of build on mortality. Three tables were required in order to demonstrate the effect of height as well as weight (unfortunately, the data on risks with excessive departures from average stature were scanty, and the mortalities for these groups could not be stated). The preceding tables were developed by the Committee, and have been quite commonly used by the underwriting departments of life insurance companies:

Dr. Knight, in a paper presented before the Medical Directors Association in 1922 ("Association of Life Insurance Medical Directors of America", Vol. IX 1922-3), stated that the average height of the short group was 5′ 5″; of the group of average stature, 5′ 8½″; and of the tall group 5′ 11.8″, (assumed to be 6′ 0″ in the following study).

Desiring to draw a picture of the effect of height as well as weight on mortality, we proceeded to translate the height and weight for each of several representative mortality percentages, into terms of the index, $\frac{w}{h^2}$, and then plot the findings on a graph in which the weight indices are abscissæ and the heights are ordinates.

The method of procedure may be illustrated in the development of Graph I, which is a study of the theoretical mortalities for age group 20-24 years. In Table I-A, (Short Group—average height 65″), a mortality of 90% is found at two points—namely for 5 and also 10 pounds over average weight. Since the average weight for 65″ for age 22 years, according to the Medico-Actuarial Table, is 135 pounds, then the theoretical weight indices for a mortality of 90% are $\frac{140 \times 1000}{(65)^2}$ and $\frac{145 \times 1000}{(65)^2}$, or 33.1 and 34.3 respectively.* These indices are now plotted on the graph at 65″ and labelled "90%". The following table gives the weight indices for various representative mortalities up to and including a mortality of 160% for age group 20-24. This table is based on mortality values given in Tables I-A, I-B, and I-C.

*Note: The index is computed on the basis of weight in pounds and height in inches. In order to derive an index of two figures, the weight is multiplied by 1000. Therefore index $= \frac{w \times 1000}{(h)^2}$.

TABLE II

MORTALITY STUDY FOR AGES 20-24 YEARS

A—Short Men

Average Height 65". Average Weight (age 22) 135 lbs.
(From Medico Actuarial Table of Build)

Mortality	Pounds from Average	Actual Weight	Davenport Index
110%	−36 lbs.	99 lbs.	23.4
100%	−23 lbs.	112 lbs.	26.6
90%	+ 2 lbs.	137 lbs.	32.4
90%	+12 lbs.	147 lbs.	34.8
100%	+27 lbs.	162 lbs.	38.3
110%	+38 lbs.	173 lbs.	40.8
120%	+46 lbs.	181 lbs.	42.8
130%	+53 lbs.	188 lbs.	44.5
140%	+60 lbs.	195 lbs.	46.2
150%	+66 lbs.	201 lbs.	47.6
160%	+72 lbs.	207 lbs.	49.0

B—Medium Height Group

Average Height 68½". Average Weight (age 22) 148 lbs.

Mortality	Pounds from Average	Actual Weight	Davenport Index
130%	−39 lbs.	109 lbs.	23.2
120%	−32 lbs.	116 lbs.	24.7
110%	−21 lbs.	127 lbs.	27.1
100%	− 7 lbs.	141 lbs.	30.0
100%	+23 lbs.	171 lbs.	36.4
110%	+35 lbs.	183 lbs.	39.0
120%	+44 lbs.	192 lbs.	40.9
130%	+53 lbs.	201 lbs.	42.9
140%	+60 lbs.	208 lbs.	44.4
150%	+66 lbs.	214 lbs.	45.6
160%	+72 lbs.	220 lbs.	46.9

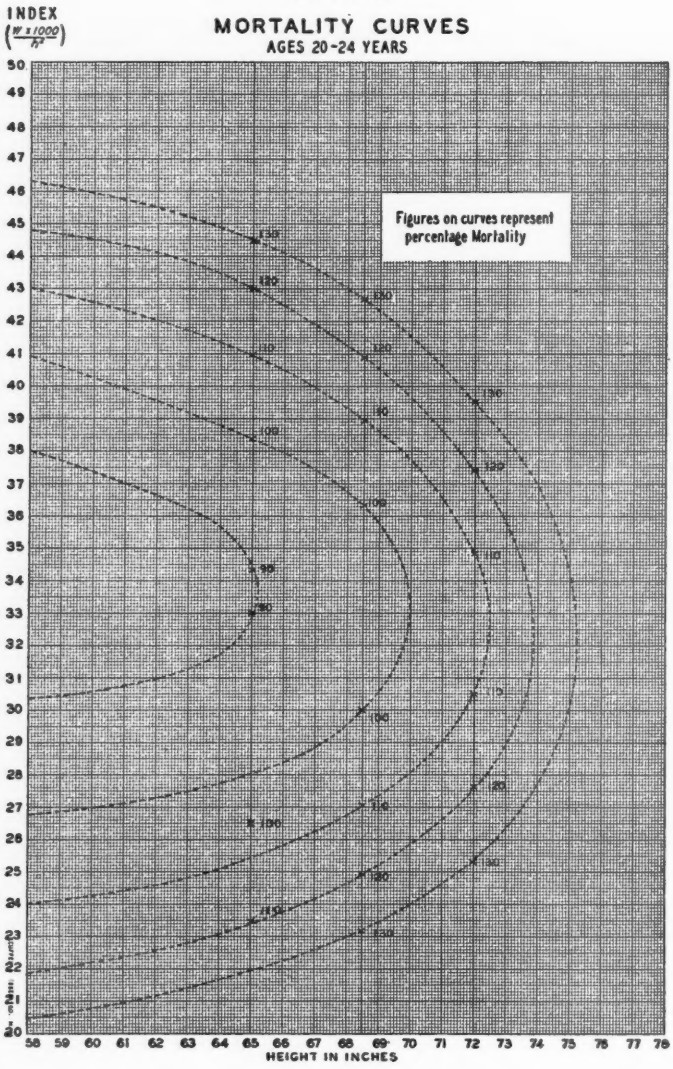
C—Tall Group

Average Height 72". Average Weight (age 22) 163 lbs.

Mortality	Pounds from Average	Actual Weight	Davenport Index
140%	−41 lbs.	122 lbs.	23.5
130%	−32 lbs.	131 lbs.	25.3
120%	−20 lbs.	143 lbs.	27.6
110%	− 5 lbs.	158 lbs.	30.5
110%	+17 lbs.	180 lbs.	34.7
120%	+32 lbs.	195 lbs.	37.6
130%	+42 lbs.	205 lbs.	39.5
140%	+50 lbs.	213 lbs.	41.1
150%	+58 lbs.	221 lbs.	42.6
160%	+65 lbs.	228 lbs.	44.0

The values for mortalities of 90% to 130% inclusive, we have plotted in Graph I.

GRAPH I


INDEX
(W x 1000 / H²)
MORTALITY CURVES
AGES 20-24 YEARS
Figures on curves represent percentage Mortality
50
49
48
47
46
45
44
43
42
41
40
39
38
37
36
35
34
33
32
31
30
29
28
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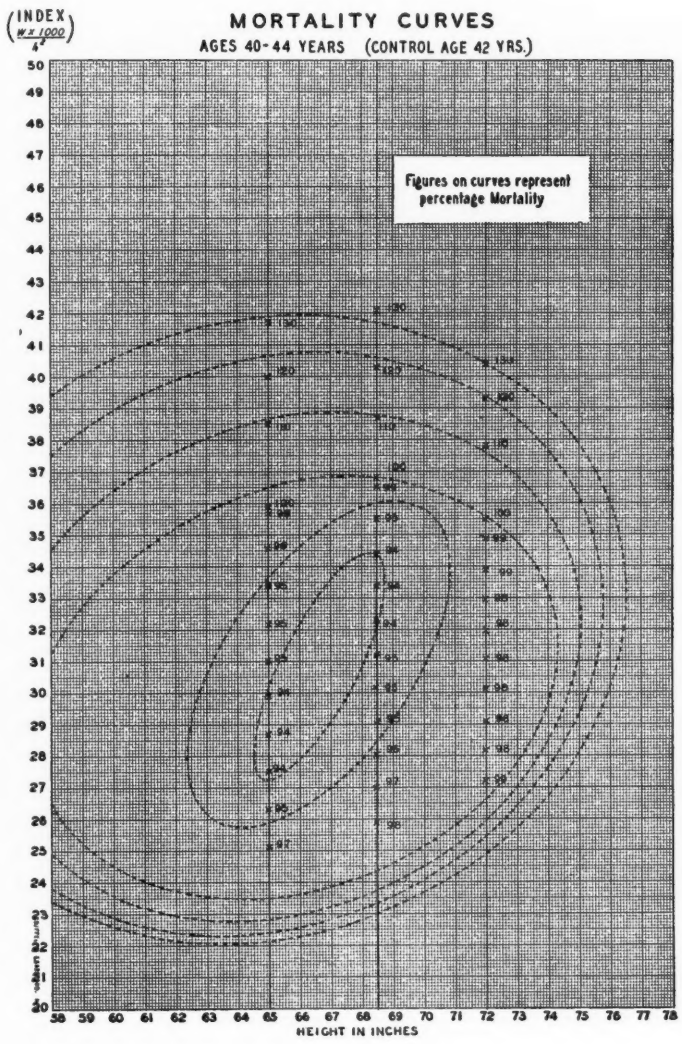
22
21
20
58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78
HEIGHT IN INCHES

GRAPH II


MORTALITY CURVES
AGES 40-44 YEARS (CONTROL AGE 42 YRS.)
Figures on curves represent percentage Mortality
HEIGHT IN INCHES

It will be quickly observed that the most favorable mortality, 90%, is found at two points only, and both for the height of 65″. The mortality of 100% is present at two points each for height of 65″ and 68½″, but is not found at a height of 72″. Furthermore, the spacing of the mortalities for 100% and over indicates that we are dealing with curves of mortality resulting from the effect of three forces—underweight, overweight, and excess height.

In the absence of figures for extremes of height and for extremes of underweight, no accurate picture appears possible. How great an effect on mortality short stature may have, it is difficult to state. That dwarfism is not, and giantism is, inimical to long life is well illustrated in the following table of ages at death of many famous dwarfs and giants cited by George M. Gould and Walter L. Pyle (Anomalies and Curiosities of Medicine—1897).

DWARFS

	Height	Age at Death		
Schaufhausen's Dwarf	2′ 10″	61 yrs.	Arrested	Development
Hudson, Geoffrey	3′ 9″	63 "	"	"
Gibson, Richard	3′ 9″	75 "	"	"
Gibson, Richard (Mrs.)	3′ 9″	80 "	"	"
Lokes, Wybrand	2′ 1½″	70 "	"	"
Ferry, Nicolas ("Bebe")	2′ 5″	22 "	Idiot	
Souvray, Therese	2′ 6″	73 "	Arrested	Development
Borwilaski, Joseph	2′ 4″	98 "	"	"
Jones, Mary	2′ 8″	100 "	Deformed	
Richeborg	1′ 11″	90 "	Arrested	Development
Stocker, Manetta	2′ 9″	39 "	"	"
Stratton, Charles ("Tom Thumb")	1′ 9″	45 "	"	"

Average age at death, 68 years.

GIANTS

	Height	Age at Death
Munster, Christopher	8′ 6″	45 yrs.
Bank Clerk of England?	7′ 6″	32 "
Antonius of Syria	7′ 7″	25 "
Tuchan, Peter	8′ 7″	29 "
Hale, Robert	7′ 6″	43 "
O'Brien ("Byrne")	8′ 4″	22 "
Cotter, Patrick	8′ 4″	45 "

Average age at death, 34 years.

If, when we plot the mortalities resulting from build for age group 40-44 years, we also include the mortalities for the percentage

94 to 99 inclusive, it then appears probable that at middle ages the four factors of underweight, overweight, subaverage and excess height will determine zones of mortality which are elliptical and not parabolic in shape. (Graph II).

Although the material is insufficient for the development of accurate mortality curves, we are, notwithstanding, justified in drawing the following conclusions:

I. The mortality rate at younger ages is influenced by underweight, overweight, and excess height, and consequently the curve should pass from overweight to excess height and then to underweight. At the older ages, the effect of subnormal height in producing increased mortality enters into the data and the picture thus obtained leads one to believe that these curves may not be, in reality, parabolic as indicated in the graphs for younger ages, and as suggested by Dr. Knight in his paper above referred to. If mortality is affected by the four factors of excess height, subnormal height, overweight, and underweight, we should expect the curve to be elliptical as suggested in Graph II.

II. With increasing age, the zone of best mortality is constantly changing in position, passing from short men of average or slightly over average weight at ages 20-24 years, to moderately tall underweights at the older ages.

III. A study by this method, of the material developed by the Medico-Actuarial Committee, indicates that, at all ages, the mortality for excessively tall men, that is, for height of 6′ 4″ and over—will be above 125%, and that these risks should be considered substandard, or, if accepted, extreme care should be used in their selection.

IV. By the use of the build index, $\frac{w}{h^2}$, one may, in the study of mortality, eliminate the use of tables of average weight for height. The value of this index in the study of mortality from build deserves further experimental consideration.

The following table is an interpretation of actual values for various indexes (19.0 to 49.8, and heights 4 feet, 10 inches, to 6 feet, 6 inches, inclusive), with an interpretation of the curves for

ILLUSTRATING MORTALITY CURVES FOR 130% AT AGES { 20 to 24 Years, A-A
40 to 44 Years, B-B

Index ($\frac{W}{h^2}$)	Height 4' 10"	4' 11"	5' 0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"	6' 0"	1"	2"	3"	4"	5"	6"
49.8	169	174	179	185	191	198	204	210	217	224	230	237	244	251	258	265	273	280	287	295	303
49.1	166	171	177	183	189	195	201	207	214	220	227	234	241	248	255	262	269	276	283	291	299
48.4	164	169	174	180	186	192	198	204	211	217	224	230	237	244	251	258	265	272	279	287	294
47.7	161	166	172	177	183	189	195	202	208	214	221	227	234	240	247	254	261	268	275	283	290
47.0	159	164	169	175	181	187	193	199	205	211	217	224	230	237	244	250	257	264	271	279	286
A 46.3	156	161	167	172	178	184	190	196	202	207	214	220	227	233	240	247	254	260	267	275	282
45.6	153	159	164	170	175	181	187	193	199	205	211	217	223	230	236	243	250	256	263	270	277
44.9	151	156	162	167	173	178	184	190	196	202	208	214	220	226	233	239	246	253	259	266	273
44.2	149	154	159	164	170	175	181	187	193	198	204	210	217	223	229	236	242	249	255	262	269
43.5	146	151	157	162	167	173	178	184	189	195	201	207	213	219	226	232	238	245	251	258	265
42.8	144	149	154	159	165	170	175	181	186	192	198	204	210	216	222	228	234	241	247	254	260
42.1	142	147	154	157	162	167	172	178	183	189	195	200	206	212	218	224	231	237	243	250	256
41.4	139	144	149	154	159	164	170	175	180	186	191	197	203	209	215	221	227	233	239	245	252
40.7	137	142	147	151	156	162	167	172	177	183	188	194	199	205	211	217	223	229	235	241	248
40.0	135	139	144	149	154	159	164	169	174	180	185	190	196	202	207	213	219	225	231	237	243
B 39.3	132	137	141	146	151	156	161	166	171	176	182	187	193	198	204	209	215	221	227	233	239
38.6	130	134	139	144	148	153	158	163	168	173	178	184	189	195	200	206	211	217	223	229	235
37.9	127	132	136	141	146	150	155	160	165	170	175	180	186	191	196	202	208	213	219	225	231
37.2	125	129	134	138	143	147	152	157	162	167	172	177	182	188	193	198	204	209	215	221	226
36.5	123	127	131	136	140	144	149	154	159	164	169	174	179	184	189	195	200	205	211	216	222
35.8	120	125	129	133	138	142	147	151	156	161	166	170	175	181	186	191	196	201	207	212	218
35.1	118	122	126	131	135	139	144	148	153	158	162	167	172	177	182	187	192	197	203	208	214
34.4	116	120	124	128	132	136	141	145	150	154	159	164	169	174	178	183	188	193	199	204	209
33.7	113	117	121	125	130	134	138	142	147	151	156	160	165	170	175	180	185	190	195	200	205
33.0	111	115	119	123	127	131	135	139	144	148	153	157	162	166	171	176	181	186	191	196	201
32.3	109	112	116	120	124	128	132	136	141	145	149	154	158	163	167	172	177	182	187	191	197
31.6	106	110	114	118	121	125	129	134	138	142	146	150	155	159	164	168	173	178	183	187	192
30.9	104	108	111	115	119	123	127	131	135	139	143	147	151	156	160	165	169	174	178	183	188
30.2	102	105	109	112	116	120	124	128	132	136	140	144	148	152	157	161	165	170	174	179	184
29.5	99	103	106	110	113	117	121	125	129	132	136	140	145	149	153	157	162	166	170	175	179
28.8	97	100	104	107	111	114	118	122	125	129	133	137	141	145	149	153	158	162	166	171	175
28.1	95	98	101	105	108	111	115	119	122	126	130	134	138	142	146	150	154	158	162	167	171
27.4	92	95	99	102	105	109	112	116	119	123	127	130	134	138	142	146	150	154	158	162	167
26.7	90	93	96	99	103	106	109	113	116	120	123	127	131	135	138	142	146	150	154	158	162
26.0	87	91	94	97	100	103	106	110	113	117	120	124	127	131	135	139	142	146	150	154	158
25.3	85	88	91	94	97	100	104	107	110	114	117	120	124	128	131	135	139	142	146	150	154
24.6	83	86	89	92	95	98	101	104	107	110	114	117	121	124	128	131	135	138	142	146	150
23.9	80	83	86	89	92	95	98	101	104	107	111	114	117	120	124	127	131	134	138	142	145
B 23.2	78	81	84	86	89	92	95	98	101	104	107	110	114	117	120	124	127	130	134	138	141
22.5	76	78	81	84	86	89	92	95	98	101	104	107	110	113	117	120	123	127	130	133	137
21.8	73	76	78	81	83	86	89	92	95	98	101	104	107	110	113	116	119	123	126	129	133
A 21.1	71	73	76	79	81	84	86	89	92	95	98	100	103	106	109	112	116	119	122	125	128
20.4	68	71	73	76	78	81	84	86	89	92	94	97	100	103	106	109	112	115	118	121	124
19.7	66	69	71	73	75	78	81	83	86	88	91	93	97	99	102	105	108	111	114	117	120
19.0	64	66	68	71	73	75	78	80	83	85	88	90	93	96	98	101	104	107	110	113	116

(Note: The graphs presented herewith must be accepted as interpretations only, and not as proved relationships with respect to mortality existing between height and weight factors.)

130% mortality shown in the original graphs (Graph I and Graph II).

Our own Company, in the past and independently of this table, has followed rather closely the limits given, in its issuance of standard insurance, though in particularly favorable cases, we have occasionally slightly exceeded these limits.

DR. RUSSELL—To discuss Dr. Clark's masterpiece we have the distinction and honor of having with us today Mr. John S. Thompson, Vice President and Mathematician of the Mutual Benefit Life Insurance Company. He is one of the most distinguished of American actuaries and an outstanding leader in the profession. Mr. Thompson is a Canadian and was educated at the University of Toronto where he was a gold medalist and graduated with honors. Prior to his present appointment he was with the Mutual Life of New York for about twenty years as Assistant Actuary and Associate Actuary.

Mr. Thompson was Editor of the Transactions of the Actuarial Society from 1918 to 1922, Secretary from 1922 to 1929, Vice President from 1930 to 1932, and President from 1932 to 1934.

He is a Fellow of the Institute of Actuaries of England, a Fellow of the Faculty of Actuaries of Scotland, and a Fellow of the Casualty Actuarial Society. He has made numerous contributions to the proceedings of various actuarial societies covering a wide variety of topics and is also a frequent contributor to the insurance press. His services are greatly in demand, both as a writer and a speaker, whether on actuarial or general insurance topics, on all branches of which he is regarded as a leading and outstanding authority. Notwithstanding his abilities and attainments, Mr. Thompson is one of the most modest and likable of actuaries, and enjoys an unusually high degree of respect and popularity among his friends and associates. It is indeed a great pleasure to introduce to you my very good friend of many years, Mr. John S. Thompson.

MR. THOMPSON—It is not my purpose to say a great deal about Dr. Clark's work as set forth in the paper which is before us today and which exhibits an ingenious transformation of the Medico-

Actuarial Height and Weight tables into charts of mortality ratios expressed in terms of the Davenport Index. The results have been developed with reasonable fidelity to the original data and speak for themselves. The paper thus extends, in an interesting way, the build studies already presented by Dr. Clark and increases the indebtedness of medical directors and actuaries to him for throwing further light on the relation between build and mortality.

This opportunity will be utilized, however, to hazard some observations on the "Index of Build" and the general ideas underlying it.

An "Index" or "Coefficient" is an abstraction which is used for comparison or classification, or for other scientific purposes, and is independent of the concrete factors measuring the data entering into the comparison. A Price Index has become a familiar figure in modern economic writings, making it possible to observe price trends from time to time or from area to area without a detailed study of specific commodities. Specific Gravity is an index of density for it enables us to compare the weights of equal volumes of various substances regardless of the size of the comparable units actually in question. A Coefficient of Elasticity is the ratio of impressed stress to induced strain, a factor dependent solely on the material the elasticity of which is measured. A "coefficient of selection", the ratio of the rate of mortality at entry to the mortality at the same age after the effect of selection was worn off, has been suggested as measuring the efficiency of selection at that age, regardless of the actual size of the rate of mortality. Such indices, coefficients or moduli have been used in the development of all practical sciences. Proceeding along similar lines, a Build Index should be a measure of, or should vary with, robustness, irrespective of actual stature, circumference or weight. The only measure of robustness in which we are deeply interested is the probability of survival (complement of the rate of mortality) either at the age in question, or at that age and all subsequent ages, as embodied in the "expectation of life". In short, an Index of Build should be so constituted that, other things being equal (that is, other factors affecting the risk such as age, occupation, habitat, etc., being the same), all lives having the same Index, whether

tall or short, light or heavy, should be subject to the same rate of mortality and have the same "expectation of life". As a corollary, a group with a different Index, other factors being the same, would be subject to a different rate of mortality, and to classify a given risk as to build we would examine, not the several features, weight, height and girth, but the Index only.

It is evident that the Davenport Index, combining weight and height, is more useful than any other single factor so far considered for classifying lives for purposes of mortality investigation. But there is some doubt as to whether we may, as Dr. Clark implies, eliminate the tables of "average weight for height" and proceed with the Davenport Index only. Consider the M-A Mortality Ratios for lives aged 40-44 with Build Indices of 40 and 45:

	D. I. 40		D. I. 45	
Weight (pounds)	Height (inches)	Mortality Ratio	Height (inches)	Mortality Ratio
140	59.2	104%	------	------
150	61.2	110	------	------
160	63.2	115	59.6	128%
170	65.2	119	61.5	138
180	67.1	116	63.2	146
190	68.9	119	65.0	152
200	70.7	126	66.7	158

The variations for lower values of the D.I. are not as marked. These points are quite evident from Dr. Clark's charts.

A study was made of two groups of male lives to whom insurance was issued in 1925, one of 7,691 lives aged 20-24 at entry, the other of 6,819 lives 40-44 at entry, with the idea of observing the mutual relationship of weight, height and girth. As in the former discussion (October, 1930) the sum of the three horizontal measurements—Chest at Inspiration, Chest at Expiration, and Abdomen—was used for "girth" rather than the average of the three. The fundamental facts were as follows:

	Age Group 20-24		Age Group 40-44	
Weight (pounds)	Average Height (inches)	Average Girth (inches)	Average Height (inches)	Average Girth (inches)
105	65.3	87.5	------	------
115	65.8	91.2	65.4	92.3
125	67.1	94.1	66.5	95.4
135	68.2	96.7	67.6	98.3
145	69.1	99.3	68.4	101.2

Weight (pounds)	Age Group 20-24 Average Height (inches)	Age Group 20-24 Average Girth (inches)	Age Group 40-44 Average Height (inches)	Age Group 40-44 Average Girth (inches)
155	70.0	101.7	69.0	104.2
165	70.7	104.1	69.5	107.5
175	71.2	108.6	69.9	110.5
185	71.7	109.9	70.4	113.4
195	72.0	113.0	71.2	116.3
205	72.0	116.8	72.0	119.2
215	------	------	72.8	119.9
225	------	------	73.1	122.8

Each age-group was thrown into ten-pound weight groups, 100-109, 110-119, etc., and each was subdivided into height groups with dividing points 58 inches, 61 inches, 64 inches, etc., and into girth groups with dividing points 80 inches, 85 inches, 91 inches, 98 inches, etc. The averages were weighted according to the numbers in the respective sub-groups. The weight indicated is not necessarily the average weight of those lives of the height shown on the same line, but the height and girth are mutually consistent with the weight with which they are associated.

The mortality ratios of the various weight sub-groups of each age-group are not the same. In the age-group 20-24, the mortality ratio ranges from about 90% in the middle weights to 105% at the lower weights and to 115% at the upper weights. In the age-group 40-44, the ratios range from 94% at the lower weights to 115% for the 6′ height-group. For the two heaviest weight groups the ratios are higher. It would have been desirable to have a series of groups with the same, or more nearly the same, mortality ratios, but for practical reasons it was not possible to separate from basic material a section which would be more homogeneous.

If there is an Index of Build which would enable us to throw in the same group all lives with the same Index regardless of absolute physical size, the Index would probably be of the form $h^t \div g$ where h denotes the height in inches, g, the girth in inches, and t is to be determined. It was found that for the group 20-24, $t = 2.54$ and for the group 40-44, $t = 2.28$. If the series of groups were more similar as to mortality possibly these coefficients would be more nearly equal.

An attempt was also made to fit the curve $W = k\ h^x\ g^y$ to each series of weights. The results were as follows:

	x	y
Age group 20-24	2.61	1.36
" " 40-44	2.47	1.52

Since k is constant the expression $W \div h^x\ g^y$ may be regarded as an index and was found to be fairly constant for each group. In case of ages 20-24, the Index $\times 10^7$ ranged irregularly from 43.59 to 44.92 and in case of ages 40-44, from 35.19 to 36.02.

By means of the relation, $g = k_1\ h^t$, we can eliminate either h or g from the Index $W \div h^x\ g^y$ with the following results:

	Ages 20-24	Ages 40-44
Index in terms of h only	$W \div h^{6.06}$	$W \div h^{5.94}$
" " " " g "	$W \div g^{2.38}$	$W \div g^{2.61}$

These results, derived by the Method of Least Squares, suggest as Indices $h^{2.4} \div g$, or $W \div h^6$ or $W \div g^{2.5}$ but must be regarded as purely tentative until a greater homogeneity in mortality in weight sub-groups is obtained and larger numbers of groups are examined. In fact, the determination of an Index, if indeed an Index of the type defined can be established, must be an experimental process since it appears unlikely that one can be based entirely upon *a priori* considerations. The essential material is a series of groups of lives of the same age and same mortality ratio but of different builds.

Notwithstanding the indications that a Build Index, if capable of definition, may involve a power of h higher than the second, these comments are not intended to convey the impression that the Davenport Index is without statistical significance. The charts shown in Dr. Clark's paper are abundant evidence that the Index may have definite, practical merit from an underwriting standpoint. Furthermore, we have thought the Index to have sufficient value to justify us in entering it on our Mortality Investigation punch-cards. In the course of our analysis of the material represented by these cards it will be possible to observe any relation that may exist between that Index and the mortality ratio, and

perchance to ascertain whether any modifications can be suggested which will improve its usefulness for classification purposes.

DR. RUSSELL—Dr. Clark, I am sure you have some additional comments to make.

DR. CLARK—It is with some degree of embarrassment that I have presented this, which I presume will be my last study of build. I feel that I should apologize to the Association for the technical papers which I have endeavored to present, feeling that I have infringed upon the prerogatives of our able actuaries and statisticians.

Nevertheless, some years ago I felt that there might be a method whereby we could secure a composite picture of the mortalities given in the three special tables of weight; namely, for short men, men of medium height, and tall men, and it was while making this study that I discovered, accidentally, the relationship between chest and abdominal circumferences and height and weight, and from which study I developed the table of measurements with which you are all acquainted.

At that time, the paper of Dr. Davenport, mentioned in this writing, was called to my attention by Mr. Thompson. A study of the value of that index as an index of build led to the discovery of the relationship in our Tables of Average Weight between each average weight for corresponding height at a given age and the index recommended by Dr. Davenport. This table, as you know, I presented last year to this Association for publication.

Later, I learned that by the use of this index, one could determine zones of mortality represented by curves on a graph, the full details of which are found in the paper which I have presented. It was necessary for me to reproduce the original tables for the various heights previously mentioned, and to include tables which are, to say the least, of little interest for bedtime reading. Nevertheless, I trust that you will be interested in at least glancing over the material which I have included, and that you will give consideration to the conclusions which I have suggested.

I feel that the final table illustrating mortality curves for 130% at two age periods will prove of value in our underwriting depart-

ments inasmuch as these curves appear to be in line with the general consensus of opinion as to the limits for desirable standard risks. I should like to state that we have to some extent used this table in an experimental way in our own department and our acceptance of overweights, underweights, and tall people rather closely coincides with the limits here given. In a study of a fairly large number of cards representing issues previous to the use of the table, I find that about 96% of our risks came within the curves represented. In the other 4%, the deviation from the limits was slight, particularly on the overweight side, representing an average of less than five pounds' variation from the limits given. The question of the insurability of tall men, Dr. Dublin is to discuss in a paper later in this meeting and I will not dwell upon that question further. I wish at this time to thank the Association for its kind consideration of the various studies which I have made. May I also personally thank Mr. Thompson for his excellent discussion and may I hope for him and for the insurance companies in general, that he will continue his study of an index of mortality. If such an index can be devised, it will have, I am sure, a very practical value in the study of mortalities from the standpoint of build.

Dr. Russell—I think we will all agree that Dr. Clark has laid the groundwork for an intensive study which can profitably be carried out by the various companies and which will add greatly to our information on this subject.

* * * * * *

I do not know how many realize that the Proceedings of our Association comprise one of the outstanding reference authorities on life insurance. If we separate the wheat from the chaff, there is a mass of most valuable material that is not found anywhere else in the literature. These volumes are used as a reference library and as text books by many of us, especially the younger men just entering the profession of life insurance.

In searching through our literature one is struck by the reference to various mortality tables, methods of computation, mortality percentages and statistics in general without any authoritative

article to which to refer. It therefore seemed to me to be very apropos if we could have a paper on the Interpretation of Statistical Principles and Mr. John R. Larus, Vice President and Actuary of the Phoenix Mutual Life Insurance Company, kindly consented to prepare such a paper. Mr. Larus is one of the best known and most prominent members of the actuarial profession. He is Editor of the Transactions of the Actuarial Society, to which he himself has been a notable contributor. His paper on "Numerical Rating Method for Family History" written some ten years ago is probably well known to most members of this Association. He is an outstanding authority on the selection of risks, mortality statistics and related matters, technical and otherwise.

Mr. Larus is a Fellow of the Actuarial Society and is also a member of the American Institute of Actuaries. Besides being an actuary, he is an amateur gardener of no mean reputation and a recognized authority on growing various types of flowers. He is also a noted bridge player and has attained championship status in the State of Connecticut. I take great pleasure in introducing to you Mr. John R. Larus.

INTERPRETATION OF STATISTICAL PRINCIPLES

By JOHN R. LARUS

Vice-President and Actuary of the Phoenix Mutual Life Insurance Co.

Life insurance in this country had flourished for many years before medical directors and actuaries could discuss problems together with greater success than co-dwellers in the Tower of Babel. The venturesome medical director who invaded the precincts of the actuary found himself greeted with a verbal barrage of "method of moments," "osculatory interpolation," and "uniform seniority," and could only counter with equally unintelligible "mitral stenosis," "intraventricular blocks," and "two glass tests." Each would retire in dudgeon to his own single track railroad, despairing of establishing contact with an utter alien. Then came the formation of the Joint Committee, and soon thereafter Dr. Oscar Rogers and Arthur Hunter found means not only of conversing together, but of weaving the fabric of a language that could be used by others to bridge the hitherto inarticulate chasm. From the time the M.A.M.I. results were made public, medical directors and actuaries have become more closely associated in their common problems, with the resultant broadened usefulness of each; and when the recent M.I.S. was published, the interpretation and adaptation of the results in many companies was a joint function. We still shake our mathematically minded heads over "deep Q waves," and you still knit your scientific brows over "inverse correlation"; that is as it should be. The shibboleths, however, are gradually being reduced to their proper limits.

At the risk of repeating much that has been already absorbed from your company actuaries and from your own reading and experience, this paper is presented to bring together some of the actuarial and statistical principles that form a section of our basis for mutual discussion and understanding.

Homogeneity and Problems of Selection

Perhaps the most vexing problem confronting one who attempts to assemble data for statistical investigation is the question of homogeneity: Is the material available uniformly representative of the classification to be studied? In such an investigation as the M.I.S., with data drawn from many companies, different methods of selection may cloud the issue or even weaken the results. The committee in charge struggled valiantly against these difficulties, in many cases analyzing the experiences of individual companies under certain impairments where seeming inconsistencies appeared. In the M.I.R., these discordant factors were taken into consideration as much as possible, so that the resultant recommendations represent the judgment of the committee as to the actual weights of the impairments themselves.

Wherever possible, the original data was subdivided into business issued standard and substandard, it being found in the case of most impairments that the standard produced a much more favorable experience. Several reasons for this situation present themselves,—

1. In the standard group there was more than the normal proportion of compensating underwriting "credits," which at least partially balanced the unfavorable effect of the impairment.
2. The severity of an impairment varies even among individuals in the same class, the least affected being given standard insurance.
3. In many instances further examinations and tests were made, standard insurance being granted to applicants where it proved that the impairment was of less than its apparent importance.
4. An applicant offered substandard insurance often will not accept it unless he agrees that he is definitely impaired; hence many of the better risks excluded themselves from the substandard experience.

From these considerations, moreover, it is apparent that the fact that a group in the M.I.S. which was accepted standard shows

a mortality of say 110% is far from an indication that the true debit for the impairment is only 10%. On the other hand, it is quite possible that certain individuals who presumably belong to a substandard class could be selected to form a smaller group that would produce a mortality rate not appreciably in excess of the normal. It seems questionable, however, whether this last practice has not at times been overdone. The M.A.M.I. showed, for example, that overweight carried a certain extra mortality. It was perfectly proper to give credits in this class for excellence of measurements, favorable occupation, low blood pressure, length of trunk, etc., *provided compensating debits were given for absence of these factors,* thus preserving the proper balance of the mortality in the class as a whole. If the robust type had been previously considered a mortality asset, it was natural to expect that part of the extra mortality shown in the moderate overweights was due to that fallacy. The ubiquitous argument, however, that inasmuch as methods of selection have improved greatly since M.A.M.I. days, greater leniency should be automatically shown in the overweight classes, seems to lose sight of the fact that selection has presumably equally improved for other classes as well, so that the relative position of overweights remains substantially unchanged. Overweight mortality percentages in the M.I.S. were almost identical with those shown in the M.A.M.I.

The M.I.S. and supplementary investigations gave evidence that high systolic blood pressure is a more severe impairment than most companies had been considering it. The recommended ratings were apparently somewhat tempered by the fact that too radical a change in selection methods in so large a class could not without repercussions be put into effect in one step; a few companies, however, have had the courage to adopt a schedule of rating more severe than those suggested.

Tests for Quantity

It is always a surprise to find how much data must be gathered before a mortality investigation may be made that will show significant trends. Companies representing 80% of the total insurance in force in the United States and Canada contributed a

great part of their experience for almost twenty years to the M.I.S., yet in many classes there was not material enough on which to base conclusions. In many more, desirable subdivisions had to be abandoned because of paucity of data. It seems strange, for example, that there were only 10 deaths in all from people accepted, standard or substandard, with epithelioma, and only 6 from those with duodenal ulcer who had suffered two or more attacks within ten years of application. The deception lies, of course, in the fact that in gauging the size of an experience we think of the number of cases accepted, while actually the determining factor is the number of deaths.

When an individual company wishes to study its experience in any class, the difficulty of lack of sufficient data is even more acute, while for any but the large companies it is practically insuperable. It takes time, moreover, to accumulate material, and to reach back into the past often involves incorporating data rendered obsolete by changes in selection methods. There is also the natural desire to have results subdivided according to age, degree of impairment, and in other ways that are a still further strain on the strength of the material.

If you will toss a coin 20 times, the odds are about even that between 42% and 58% of the times you will throw heads. If you toss it 40 times, the odds are even that you throw between 45% and 55% heads. As you increase the number of throws, you obviously reduce the variation from absolute agreement between the facts and the theory that heads and tails should each occur 50% of the time. The following table shows the way the percentages close in around 50%:

No. of Throws	Even Chance That Heads Will Be Between	90% Chance That Heads Will Be Between	99% Chance That Heads Will Be Between
20	42%–58%	32%–68%	21%–79%
30	44%–56%	35%–65%	26%–74%
40	45%–55%	37%–63%	30%–70%
50	45%–55%	38%–62%	32%–68%
100	47%–53%	42%–58%	37%–63%
500	48%–52%	46%–54%	44%–56%
1,000	49%–51%	47%–53%	46%–54%
10,000	50%–50%	49%–51%	49%–51%

While it would take an uninterestingly long time to develop these probabilities by actual trial, a very simple formula has been evolved which will give the results with little effort. It has been worked out that $\frac{2}{3}\sqrt{npq}$ [where $n =$ the number of trials, p the probability of success (i.e. heads), and q the probability of failure (i.e. tails)], will give the 'probable deviation';—i.e. the variation from normal that may be expected to be exceeded half of the time. Taking the example above, for 100 throws we have $\frac{2}{3}\sqrt{100 \times \frac{1}{2} \times \frac{1}{2}} = 3\frac{1}{3}$, which is approximately 3% of the number of throws,—checking with the result given above. The same formula may be slightly changed in order to calculate the last two columns of the table. For example, a little less than four times the 'probable deviation' gives us the basis for calculating the range within which 99% of the trials will fall. (The 'probable deviation' for 100 throws being $3\frac{1}{3}$, in 99% of the trials we should have a variation of not over 13,—slightly less than $4 \times 3\frac{1}{3}$,—indicating a range of 37%-63% as shown.)

If we have, by actual trial, obtained a certain result, we are naturally interested to know whether the variation from normal is due simply to chance or to the fundamental nature of our material. If we obtained 600 heads from 1,000 throws of a coin of which we were suspicious, we would wonder whether we had *proven* that the coin was not normal. Since it has been shown that a normal coin would produce even as many as 540 heads (54%) not more than once in a hundred series of tests, it is practically certain that another factor is at work, especially if there was previously cause for suspicion.

This same method is easily adaptable to mortality investigations,—even the more readily because of a resultant simplification that we can use. In the case of a coin, p is the chance of success (heads), and q that of failure (tails); in the case of a mortality study, it follows that p becomes the chance of living a year, and q the chance of dying in the year. For almost all ages involved, the chance of living a year is about .99, and as multiplying any number by .99 practically leaves it unchanged, no appreciable error is introduced by omitting the p from the formula and writing $\frac{2}{3}\sqrt{nq}$. In a mortality investigation, n (the number of trials)

becomes the number of people exposed to death, so that the product of this quantity and q (the chance of dying) obviously equals the number of deaths. This still further reduces our formula to $\frac{2}{3}\sqrt{d}$, where d is the number of deaths in our experience. If then we are investigating a class in which there are 100 deaths, we may expect that even if the group is normal, there would be an even chance of a variation of $6\frac{2}{3}$ $(=\frac{2}{3}\sqrt{100})$, so that if our expected deaths (calculated from a normal table) were 94, our actual variation has been less than we would expect 50% of the time from pure chance. If, however, the expected deaths were 73, differing from 100 by four times the 'probable deviation,' we could assume that there was only one chance in 100 that our class could, by the operation of the laws of probability alone, have a true expected of 73 and thus be homogeneous with the standard.

In the M.I.S., the 'probable deviation' has been translated into a variation in the mortality percentage and has been placed after the percentage derived for each class (preceded by a plus and minus sign, as the variation may occur in either direction). If the mortality percentage in a class differs from 100% by as much as three times the appended variation, it is considered that the deviation is definitely significant.*

These same principles are adaptable in order to ascertain roughly whether a company has enough experience of its own in a class to justify an investigation. If, for example, there have been 50 deaths, four times the 'probable deviation' $(4 \times \frac{2}{3}\sqrt{50})$ gives 19, so that unless the expected deaths were anticipated to be less than $50 - 19 = 31$ (or over $50 + 19 = 69$), little can be *proven,* although suspicions may be aroused by somewhat slighter variations. As expected deaths of 31 would, for 50 actual deaths, produce a mortality of 161%, it is apparent that slight deviations from the normal could not be proven, and even wide variations could not be pinned down to anything approaching an exact figure. If, however, the expected deaths were actually calculated and found

*There is some difference of opinion as to whether the variation should be considered in relation to the actual or the expected deaths. In the M.I.S. the actual deaths were used as the base, which usually gives a larger result and to some degree balances the use of three instead of four times the 'probable deviation.' Throughout this paper the issue has been ignored, while the conservative figure of four times the 'probable deviation' has been employed—although the smaller multiple may be used with reasonable safety when the results obtained are in line with expectations.

to be 20, the method given on page 12 of the M.I.S. would give a mortality ratio of 250% ± 24%, so that the probabilities would be that the true mortality of the class (i. e. removing any variations because of paucity of data) would lie between 274% and 226%, while a variation of 96% (4 times 24%) would be almost beyond the realms of chance; we could, therefore, with assurance say that the true mortality lay between 346% and 154%,—with the very decided presumption that the truth was somewhere nearer the average than the extremes.

As a general rule, 100 deaths are considered sufficient to warrant an investigation, although a smaller number may be used if the class is known to be or strongly suspected of being decidedly abnormal.

The necessity of having sufficient numbers in a class is in direct variance with the desire for subdivision. Usually it is wise to collect and study the material in moderate subdivisions and then throw it together if results are not conclusive when considered separately. This method has at least the advantage of enabling the operator to see whether one or more subdivisions are unduly influencing the total result.

Standards of Comparison

Many times a difficulty is encountered in arriving at the proper basis for calculating the expected deaths—the yardstick by which our experience is measured. The most accurate method is, of course, to calculate a mortality table for all standard risks and then use it as the measure of any smaller groups desired. Unless this has been done for other purposes, however, the procedure is arduous and expensive. If a company's mortality corresponds in a general way with that of other companies, one of the basic tables that have been prepared may be used.

For valuation and annual statement purposes, the American Experience Table has long been accepted as the standard. A change would necessitate altering the laws of many states, and abandoning principles regarding reserves and surrender values that have been evolved through bitter experience. This table, however, was prepared almost 80 years ago and not only incorrectly

reflects the mortality of present conditions (greatly exaggerating the mortality rates at the younger ages), but entirely ignores the influence of selection. As an index of how a company's mortality is progressing from year to year, it can furnish a fairly accurate check—unless the distribution of business by age and policy year is changing rapidly,—but as a basis of comparison between different companies or a criterion for a mortality study of certain classes of business within a company, it may introduce serious fallacies.

The Joint Committee is now maintaining a continuous experience, incorporating annually one more year's data, so that for investigations that do not reach back far into the past we have a ready-made yardstick. The so-called "Basic Tables" are in select form, which means that the different policy years are kept separate and initial selection thus taken into consideration,—an important point in making valid comparisons.

Time Restrictions

Unless we delve back so far into the past that our experience is outmoded before it is prepared, we are usually limited to the first five or ten policy years. Thus we can measure the influence of an impairment for only a comparatively small number of years after issue. Where the effect of the impairment remains approximately constant throughout life, this is no drawback, but where its influence on mortality is steadily increasing, by omitting the later policy years we naturally understate. If, over successive five-year periods the extra mortality from a certain impairment is 10%, 20%, 30%, 40%, etc., a study of policies none of which has been in force more than ten years would indicate an additional mortality of about 15%, whereas the average excess to be provided for would obviously be much greater. When, as is usual in order to incorporate as much up-to-date experience as is possible, all business issued within the last 10 or 15 years is included, we are still further over-emphasizing the experience of the very early policy years, for while most of the years of issue contain the data for the first policy years, only the earlier calendar years studied have been in existence long enough to develop material

for the longer durations. If, for example, the experience on all business issued within the last ten years was used as the basis, we should have the issue of all ten years exposed for the first policy year, of nine years for the second, of eight for the third, and of only one for the tenth. We should in effect be looking through the large end of a telescope and thereby be minimizing the due importance of what lay ahead. These illustrations may suffice to show the potential dangers in accepting derived mortality percentages as unquestionably authoritative.

Principles of Sampling

Occasions sometimes arise when we have more data at our command than we actually need. If, for example, we wished to determine roughly the percentage of our applicants that was examined by country physicians, it would suffice to study only a few hundred applications, which might comprise only as much as a day's business. If, however, we selected those applications successively, we should probably violate the statistical principle which demands that when we sample, we do so in such a way as to eliminate extraneous influences. It might well be that an unduly large number of applications had arrived on that particular day from one agency; it might equally well be that we should be subjected to an artificial seasonal trend; Monday's applications might, moreover, vary in composition from Friday's; or other errors might be introduced. We should always adopt a method of selecting our material that avoids so far as possible these dangers. Probably the best way to ensure a 'random sampling' is to select material evenly spread throughout a year; if 1% of the year's business is needed, we could conveniently and correctly use only policies whose numbers end in "00."

In such a study, our principles of probability supply the hint as to how many cases we should examine. Unless the probability we are trying to determine varies considerably from ½, we may use the table on page 4. From that we see that if we examine 500 cases, there is only about one chance in 10 that our error will be as great as 4%, and only one in 100 that it will be as great as 6%. If such accuracy is acceptable, 500 cases will suffice; other-

wise, we must increase the number studied. An application of the formula $\frac{2}{3}\sqrt{npq}$ to actual conditions will, of course, give a more exact index.

Limitations of Statistics

Statistics may usually be relied upon to indicate the theoretical answer to a question. Even if accurately prepared, however, they cannot always take into account variations in conditions. Many of us have heard the statement made that Presidents enjoy a better mortality than laborers, because the average age at death of a President is 70, while that of a laborer is 55. The calculations from which those statistics have been gathered may have been made without error, yet they neglect the all-important fact that laborers start as such at 20 or even younger, while one is normally not elected President before reaching 50. In obtaining the average age at death of laborers, therefore, all dying within their twenties, thirties, and forties are included, serving to bring down the average, while among Presidents, there are, under our assumption that inauguration occurs after 50, no such early deaths. The only way to make a satisfactory comparison would be to apply statistical methods to a study of the actual and expected deaths in the two groups, so that our principles of homogeneity would not be violated.

A statistical finding that is unassailable theoretically may sometimes, moreover, not give the entire answer to our problem. We have all, for example, faced the question of how to handle requests for reinstatements on impaired lives. If there is a long period of extended insurance and if disability or double indemnity benefits are not involved, we reinstate irrespective of insurability, for our company is on the risk under the lapsed policy for a longer time than we expect the insured to live, and reinstatement will salvage any premiums that are paid. Without extended insurance, theory tells us to refuse to revive standard insurance on impaired lives, yet practical considerations remind us that reinstatements place policies on the company's books without the cost of a first commission or first year expenses; accordingly, we make it a practice to revive cases where we do not anticipate mortality over,

say, 135%. Where there is a moderate duration of unexpired extended insurance, we use our judgment and weigh the gain in premiums against the assumption of continued risk. This is an instance where the theoretical approach to the problem, while vaguely possible, is so complicated that we usually take the more direct route of personal judgment.

If the holder of a substandard policy subsequently becomes more seriously impaired, we normally have no way of further increasing his premium. From theoretical grounds, therefore, we should not remove the rating on a substandard policyholder whose condition has cleared up. Unfortunately for our theory, however, he is now able to surrender his rated policy and obtain a new standard contract, so that for practical reasons we usually remove his extra premium. If, however, although the feature for which he was originally rated has disappeared, he has acquired a new and unrelated impairment, the practical exigencies of the case cease to operate and many companies refuse to make any adjustment. Companies' practices would probably differ as to whether a mail pilot's rating should be removed if he had definitely changed to a nonhazardous occupation, but had recently been operated upon for gastric ulcer. Both the Canadian Life Insurance Officers' Association and the M.I.R. have reduced the number of these embarrassing cases that will arise in the future by their recommendations of suitably adjusted temporary extras for many medical impairments which are of such a nature that the hazard is primarily an immediate one.

Theoretically, it should be possible to determine the largest policy that a company should accept on a single life, the main element in any formula being the amount of surplus strain the company could stand from the chance occurrence of several of these large claims in a year. The fact that policies resulting from large applications usually produce a heavy mortality hardly deserves theoretical consideration,—for if the issuance of the full amount is a losing venture, the case should be declined for any amount (the insurance will normally be placed somewhere, so the character of the risk cannot be changed); we may, therefore, assume that whatever large cases are accepted should be productive of profita-

ble mortality in the long run. It is an almost universal practice, however, for companies to adopt a much lower limit than would be theoretically necessary, due in great part to the fear that, for "business reasons," large policies might slip through from which a mortality sufficient to cause actual loss would result.

Many companies limit the amount they will accept on borderline cases to a fraction of the amount applied for. This last practice not only seems to violate theoretical grounds, but to have little practical justification. If a hundred borderline applications for $100,000 each are received, the company which attempts to select the best quarter of them, accepting those for the full amount and rejecting the others outright, should obtain more favorable results than the company which accepts all of them for $25,000,—assuming that the first company's underwriting judgment as to the ones it chooses results in a selection even slightly better than if it had automatically accepted every fourth case; *each company will have the same total amount at risk on individuals of the same class.* A surprising number of companies, however, still rely on the "limited amount" method of underwriting doubtful cases; possibly they can point with pride to the limitation if an early claim eventuates, although the very fact of refusing to take the normal amount in such case appears to indicate the acceptance of a risk which they are tacitly admitting to be presumably unprofitable.

In the substandard field, however, it seems proper from practical grounds to adopt lower limits than for standard cases, for if any company conspicuously raised its substandard acceptance, it would get more than its share of a type of business in which we are admittedly still engaging in experimental research; not only would it receive larger units, but agents of other companies would be quick to realize the enlarged field for their substandard overflow.

A somewhat analogous situation would be faced by the company which adopted conspicuously liberal underwriting practices. Statistical investigation might show that only 5% of the company's applications had been coming from the class of risks where the expected mortality lay between 130% and 150% of the normal,

and calculations might seem to indicate that to accept this group as standard would increase the company's general mortality by not over 2%. As soon, however, as the field force realized its opportunity, applications would pour in from a class which before was being abandoned as hopeless, while there would also arise another avalanche originating from the opportunity offered other companies' salesmen; the resultant effect of the experiment on the company's mortality, therefore, would be greatly in excess of the statistical estimate.

While no company would consider accepting all risks rating up to 150%, there have been several attempts on the part of companies to relax their underwriting requirements on certain specific types of impairments where for one reason or another they were willing to adopt a particularly liberal view; even if, however, the officials of a company should believe that certain types, noticeably impaired in the opinion of others, would produce standard mortality, considerable care must be exercised to prevent so great an influx of these uncoveted cases as to result in serious loss in the event that the other companies were right after all.

The underwriting of risks can obviously never be reduced to simply theoretical standards. We can, nevertheless, strive to decrease the amount of purely intuitive judgment necessary, and to substitute therefor to an increasing extent the interpreted results of statistical studies,—the joint product of medical and actuarial cooperation. Any advance leading toward this goal is a privileged one, and I am deeply grateful to your Association for having, through your President, created the opportunity for this discussion of some of our mutual problems.

Dr. Russell—There are many different phases to the interpretation of statistics and no one recognizes this better than our next speaker. Mr. Joseph B. Maclean, Associate Actuary of the Mutual Life Insurance Company, has one of the keenest, most analytical minds of any one whom I have ever met.

Mr. Maclean was born in Glasgow, Scotland. He started in as an Actuary in the Scottish Temperance Life Insurance Company. In 1911 he came to the Mutual Life but left to serve at the outset

of the World War. He entered the British Army and was decorated with the Military Cross. Since 1920 he has been Assistant Actuary and Associate Actuary in the Mutual Life. His book on life insurance is the outstanding authority on life insurance in general. He is a lecturer who has been connected with Columbia University. He is a Fellow of the Faculty of Actuaries of Scotland, Fellow of the Institute of Actuaries of England, Fellow of the Actuarial Society of America, and an Associate of the American Institute of Actuaries. Mr. Maclean is the Secretary of the Actuarial Society, and Chairman of the Examining Committee of that Society.

Incidentally, he is a wonderful talker, with a wealth of stories. It is a great honor for me to welcome him here to give a contribution of Mr. Larus' able paper.

MR. MACLEAN—My first and most agreeable duty is to thank you for having invited me to take a small part in your Proceedings, an honor which I very much appreciate. I am also flattered to notice that you have exhibited, no doubt for my special honor, a flag of Scotland which is about double the size of your own flag of the United States.

If I might presume to speak for the Actuarial Society, I would like to say that we are very glad to be represented here by two of our most distinguished members, Mr. Larus and Mr. Thompson. We could not ask for better representatives, and I am sure that no one that I know of can speak with greater authority on the subject of mortality statistics and any related topic than these two gentlemen. In fact, if each of them possessed one more qualification, which unfortunately they lack, they would belong to the category of perfect actuaries. I mean that neither of them is a Scotsman.

Mr. Larus has stated and illustrated some of the fundamental principles applicable to the interpretation of mortality statistics. There is little, if any, room for disagreement with anything in the paper. My remarks will therefore be supplementary rather than critical.

As a preliminary I shall, in accordance with a suggestion made to me, say a few words as to the relative significance of mortality statistics based on lives, policies or amounts of insurance.

By definition the rate of mortality at any age is the proportion of *persons* of that age who die in a year. To obtain the rate of mortality or the comparative rates of mortality in different classes we must therefore deal with *lives,* not policies nor amounts of insurance. If we deal with either policies or amounts we obtain, not the death rate but the rates of *termination by death* either of policies or amounts.

This is obviously not quite the same thing as the death rate. In an investigation by policies, ten policies on the same life count as ten exposures and, if terminated, as ten "deaths", unless adjustments are made such as are referred to later. Similarly, in an investigation by amounts a policy of $10,000 on one life represents ten times the exposure and, if terminated, ten times the deaths as compared with a policy of $1,000. Neither policies nor amounts, therefore, can give us the true measure of the death rate. In the M.A.M.I. the application, or "selection unit", was the basis of the experience. This basis gives rise to certain practical difficulties and in the Medical Impairment Study and the Joint Occupation Study the basis of the observations was policies.

For practical purposes, however, and in view of the natural limitations of all such statistics, no serious error is introduced by the use of policies or amounts rather than lives in the construction of a mortality table. Because of the practical difficulty of eliminating duplicate policies as is necessary when an investigation is based on lives, it is now almost universal practice to construct insurance mortality tables on the basis of either policies or amounts. The termination rates produced by such an investigation are fairly close to the death rates based on lives provided the exposures are large. For financial purposes—such as computations of premiums and reserves—it is, in fact, not the death rate among lives but the rate of financial loss by death in which we are interested so that for the latter purpose a mortality table based on amounts rather than lives is preferable.

For *comparative* purposes such as the preparation of mortality ratios applicable to groups of impaired lives the results will be about the same provided both the standard table used for comparison and the observed data are on the same basis and provided the groups are of good size. As a matter of fact, in both the M.I.S. and the J.O.S. the basic mortality table used for computing the expected mortality was based on amounts although, as just stated, the basis of the observations was policies. This was done because of the limitations of available material.

In small groups violent fluctuations from the true ratio of death rates may be caused by the use of policies or amounts rather than lives but in such groups the results are, in any case, of little significance. In recent joint studies steps have been taken to make allowance for irregularities due to an abnormal number of policies in the deaths in any one group and also to check the mortality ratios in small groups by a comparison of the death rates by cause in the group and in the entire study. By such methods even comparatively small groups may be of use in furnishing significant information.

I shall now consider briefly the two questions—(1) What is the meaning and significance of a "Mortality Ratio"? (2) How can the information given by a "Mortality Ratio" be translated into appropriate action?

(1) *What is the meaning and significance of a "Mortality Ratio"?*

When we say that the "Mortality Ratio" of a specified impairment group is, for example, 150, we mean that among the lives (or, more usually, the policies) constituting the observed group there were, during the particular years covered by the investigation, 150% of the terminations by death which would have occurred if the mortality rates experienced had been the same as those by the standard table used for comparison and by which the "expected" deaths are computed.

Such a ratio may tell us very little as to the extra mortality to be expected among persons subject to the particular impairment under consideration. Reasons for this are: (1) the material may be too scanty to give significant results; (2) the period of time

observed, being limited, may include too high or too low a proportion of the total extra mortality which would be experienced if the observations were not limited in time; (3) the cases observed may be abnormal in some way so that the effect of the impairment is either accentuated or neutralized by other factors.

It may be interesting to consider each of these three disturbing factors briefly since they are all present to a greater or lesser extent in every investigation into substandard mortality.

Many impairment groups are so small in numbers that the ratios obtained have only a low degree of credibility. Observation of a similar body of material would, in that case, quite probably give a materially different result. Unless the results in such cases are supported by other statistics or by general considerations, they can be of little value as indicating the true extent of extra mortality. In fact, to be of real value, the group must be sufficiently extensive so that when broken down into sub-groups by age and by duration it will give a reasonable idea of the *incidence* of extra mortality which is an essential factor in selecting the appropriate *method* of rating. Very few impairment groups, however, are sufficiently extensive to give significant results when subdivided in this way. In fact, in many groups the entire experience is not sufficient. This can be seen by inspecting the mortality ratios and probable deviations given in the M.I.S. In some cases these indicate a spread of probable extra mortality ranging from distinctly standard to distinctly substandard. Moreover, as Mr. Larus has pointed out, the probable deviation does not cover the possible range within which the true mortality may lie, but merely the range within which it is an even chance that the true mortality lies. The conclusion is that the ratios in many cases must be regarded merely as collateral information to be used in conjunction with other sources of knowledge and subject to modification by independent judgment.

Again the period of time observed has a considerable bearing on the results obtained in the form of aggregate ratios. Where observations are limited—as they always are—to a comparatively small number of recent policy years the total or aggregate ratios are weighted heavily by the more numerous early policy years.

In addition, if the period of the investigation is limited there must be a tendency in using aggregate mortality ratios to overstate the aggregate mortality of the decreasing risks and to understate the aggregate mortality of the increasing risks. In other words, in an investigation covering ten, fifteen, or twenty years, which includes a large proportion of recently issued business, there is no time to experience the full effects either of the better years in the former case or the worse years in the latter case.

To meet this difficulty ratios are prepared in select form as in the detail tables of the various published investigations, and in any consideration of rating a study of the detail tables is essential. Only by such a study can we see the true nature, extent and incidence of the extra mortality and then only provided the data are sufficiently extensive to be capable of such subdivision.

The third disturbing factor to which I have referred is the possibility that the observed data may be abnormal in some way (using the word in a strictly technical sense) so that the results obtained may not be applicable when applied to other apparently similar material. The most usual abnormality of this character arises from special standards of selection in the original observations. For example, in the M.A.M.I. the investigation covered only persons to whom insurance was issued at standard rates. As is pointed out on page 5 of Volume IV of that investigation, this means that the impairment was in each case offset by higher than average standards in other respects, so that the mortality ratios given in that report do not show the effect of the various impairments. These ratios are, in fact, very little more than an index of the success of the selection in the different classes and cannot provide a basis for estimating extra mortality unless precisely the same selection is enforced, nor any exact information as to comparative amounts of extra mortality. This is clear from the fact that in some impairment groups the mortality is standard, showing no extra mortality in spite of the impairment.

In the M.I.S. both standard and substandard business was investigated and the results are given separately. This gives a good deal more information but the ratios are still subject, in some degree, to the same limitations as in the M.A.M.I. as is stated on

page 14 of the introduction to the M.I.S. As you know, in some impairment groups the standard business showed a higher mortality ratio than the substandard. This merely indicates differences in selection, and the ratios, as before, do not supply a measure of the amount of extra mortality to be expected except under the same conditions of selection.

All of this may be disturbing to those who suppose that tables of mortality ratios for substandard groups give definite information as to the extent of extra mortality but it need not be so. If we appreciate the limitations of such figures and do not misinterpret them they are of the utmost value. Their true function is to indicate in a general way the *relative* degree of extra mortality as compared with standard risks or as between one impairment and another, which will probably result from selection of a certain character. With that knowledge supplemented by other available information, and knowing the character of the selection which will be enforced, we are in a position to make a fairly intelligent grouping, in a broad way, of impairment classes according to the probable degree of aggregate extra mortality which may be expected.

This brings us to the second question:

(2) *How can the information given by a "Mortality Ratio" be translated into appropriate action?*

We have seen that the Mortality Ratio *in itself* does not necessarily indicate the amount of extra mortality to be expected. In the same way, the Mortality Ratio *in itself* does not indicate the appropriate method of rating. Two impairments in a given investigation may show precisely the same aggregate Mortality Ratio, but the appropriate methods of rating may be quite different. The method of rating determines the amount of premium which the applicant is to pay and the fundamental financial consideration is that the premiums received from any group of policyholders will be sufficient to pay for the claims in that group. If the extra deaths are expected to occur in the early policy years more extra premiums must be collected for the same number of extra deaths than if these will occur in the later policy years. Here, again, the im-

portance of taking into account the incidence of extra mortality is apparent.

It might be observed, however, that we should not expect to be able to apply any considerable refinements in the practical rating of extra risks. In the nature of the case that is impossible, not only because of difficulties in measurement and determination of method, but because of the relatively small proportion of business involved.

Lives which are classified as standard are composed of many groups which individually would show mortality ratios ranging from, perhaps, 70% to 125% or 130%. In other words, some of the groups classified as standard have an aggregate mortality experience nearly double that of other groups also classified as standard. These considerations lead to one point of view in regard to methods of rating which has a good deal to be said for it, that is, that for practical purposes and recognizing the practical limitations, it is sufficient to make a few broad groupings according to aggregate mortality ratio, ignoring entirely such refinements as incidence of extra mortality with respect either to age or duration. Under such a system individual risks would simply be allocated to their particular percentage mortality class in a few broad groupings, and premium rates would be determined on the basis of extra percentage mortality tables accordingly. It is evident that mortality ratios such as those provided by the M.I.S. are of practical value in such a plan provided we keep in mind the degree of selection required to obtain the results indicated.

The alternative is to make a detailed study of each particular type of impairment both as to the amount of extra mortality and its incidence and to determine therefrom, not only by consideration of mortality ratios but by making use of all other subsidiary information as well as personal judgment, a reasonably suitable form of extra rating. This is the process indicated in the introduction to the Medical Impairment Ratings. It will be seen that the rating assigned, if it is in the form of a percentage addition to the mortality as is usually the case, is not necessarily the same or even approximately the same as the mortality ratio in the M.I.S. for the corresponding impairment group. As the Committee ex-

presses it, these ratings were decided upon in various ways after discussion among the committee members. They express not only the statistical results, but the composite opinion of the probable mortality to be expected on the basis of a certain type of selection.

When individual impairment groups are examined, analyzed and discussed in this way, it is possible to differentiate according to the types of extra mortality as has been done in the M.I.R. There are, of course, practical limitations on the extent of differentiation. Thus, in the M.I.R. only two main systems are adopted. Where the additional mortality is expected to continue for a long period the rating is simply expressed as an aggregate percentage, this percentage representing the average aggregate extra mortality. Where the extra risk is temporary the extra mortality is converted into a temporary extra premium corresponding to the number of extra deaths to be expected in the period during which there is an extra hazard.

Where the ratings are in the form of average aggregate percentages these may be used to allocate the risks into extra percentage table classes as indicated above, or they may be translated into financial equivalents in other forms of extra rating. That is, of course, an actuarial problem.

DR. RUSSELL—The discussion will be opened by Dr. Frank L. Grosvenor,. Medical Director of the Travelers Insurance Company.

DR. GROSVENOR—Perhaps were I born again, I might then have the mental ability and training which would permit me to discuss the actuarial subdivisions of this paper as to homogeneity, tests, quantity, proper deviation, time restrictions and principles of sampling. Even at that, this is highly improbable. Any such discussion should, and I expect will, be brought out by my colleagues from the actuarial side.

Coming to the subject "Limitation of Statistics", I can say little because the author's statements appear to me eminently sound with the possible exception of the reference to the reception of one hundred borderline applications for $100,000 each. I am not so sure that these one hundred borderline applicants could be so

sufficiently similar as to place them all in the same category and it would appear to me that individual selection might permit more judicious handling of this class than the acceptance of one-quarter of them for the full amount, and the rejection of three-quarters, or, on the contrary, the acceptance of the entire group for one-quarter the amount applied for. It seems to me that the author has overlooked the principle of distribution in the example which he quotes.

Because it antedates my own experience, I find it difficult to appreciate conditions as are said to have pertained in the past when Actuaries and Medical Directors could not discuss their mutual problems with success and with assistance to both. Of course, it is still necessary at times to exercise a bit of patience, with malice toward none and charity toward all. When this is done, no Actuary need be unduly perturbed in the matter of deep Q waves, intraventricular block or mitral stenosis, as no Medical Director need be perturbed by the barrage of an Actuary on purely mathematical matters. If he has been presented by his Actuary with a suggested plan of rating for, let us say, increased, decreased or absent patellar reflexes to be applied without consideration of etiology or pathology, if existent; or if he is presented, for instance, with a table of ratings for abnormal blood-sugars without consideration of the matter of food ingestion or the reaction to food ingestion as determined by the blood-sugar curve, it is time for that Medical Director to be charitable and gently suggest to his Actuary that there are factors other than figures to be considered in medical underwriting. If the Medical Director attempts to insert his oar in the matter of mathematical principles, I do not think the Actuary should exercise much charity in telling him to get out. Even so, a common ground of understanding and operation will be developed.

For business reasons rather than lack of knowledge, Life Insurance Medicine may trail somewhat behind experimental and advanced medicine but business reasons, so-called, are not alone responsible for this. Time is necessary to separate the wheat from the chaff in experimental medicine. Personally, I have never been wholly satisfied with a statistical study of the results obtained

in connection with impairments reported as such for the purpose of warning that a hazard exists. The requirements of Medical Departments vary; the quality of their examiners may vary; and there is very much of the element of personal equation all the way through, even up to the matter of the cause of death when it eventually occurs.

I suppose the actuarial viewpoint is that all these things equalize on the average, and that may be correct. In any event, it appears to be the only way devised whereby a sufficient volume may be studied to permit of any real estimate of the results and experience. Would that more Medical Directors were endowed with mathematically trained minds, as was Dr. Rogers. Even as it is, perhaps the most of us eventually grasp something of the actuarial meaning, as I know the Actuaries grasp to a much greater extent what we mean.

DR. RUSSELL—Dr. Olin M. Eakins, Vice President and Medical Director of the Reliance Life Insurance Company, will continue the discussion.

DR. EAKINS—The good Russell, our President, is usually a man of judgment. However, knowing me as a surd, knowing that a statistic would pass me unrecognized, and asking for this discussion of a presentation from the pen of the erudite Mr. Larus, he evidences a questionable determination. It is fitting, then, in the same breath to compliment Mr. Larus, castigate Dr. Russell and sympathize with you.

A Statistician, worthy the name, might be inclined to rise in his wrath and smite one or sundry who dared aver that statistics are of just about as much use as fins to a bird until such time as they are interpreted. That same Statistician, however, must agree that interpretation is necessary for most of us who are not so well versed in the "numbers racket". The difficulty arises in how to interpret properly. Given one set of statistics and three interpreters, the result, frequently, will be three answers as divergent as the legs of a tripod. An example is the recently expressed opinions concerning the National Budget by the two political parties, and by the side-lined public.

By admitting that statistics must be interpreted, we imply that the meaning of any given statistics might be construed differently according to the mental equipment, experience and bias of the interpreter. Briefly, it boils down to an individual opinion. We are told differences of opinion make horse races; but does this adage apply on a more scientific plane when we seek yardsticks by which to measure accurately the meaning of available statistics? Unfortunately it does, occasionally, as evidenced by the dissimilar action of various companies on the same applicant for insurance. The ramifying grief of this divergence acts as a diapnoic to the two or more interpreters of diametric persuasions.

It may be an impertinence to draw a parallel between the arts and statistics, one being discretionary, the other supposedly exact. But music, a mathematical art, may be thus employed without painfully stretching any imagination. The music of the masters is considered technically perfect. Why should the Beethoven Fifth Symphony differ in appeal under the baton of Arturo Toscanini and under the cigar of Ben Bernie? It is the same opus. The notes appear in the same sequence. Yet, here are two men with different conceptions of the same music. The difference is in interpretation. Alas, poor Beethoven!

Is it possible to standardize interpretation? Can we all see eye to eye and come to the same conclusion regarding a given set of statistics? It does not seem humanly possible. There are still those who believe that "the reverse of every truth is also true". We still have with us "doubting Thomases" who believe nothing except that which they prove for themselves, and then only half of it. Anything can be "proved", given a certain number of facts and a few untenable assumptions. Take the gain and loss exhibits of life insurance companies as a horrible example. A lower rate of mortality in one company spells, to one interpreter, a more careful selection of its business. Another interpreter knows it spells nothing of the sort because he is aware that the company having the higher rate of actual to expected mortality also has on its books a far larger percentage of policies much longer in force. That, and other erroneous interpretations, recalls the remark once made by a noted actuary that, "to give an uninformed person the task

of interpreting a gain and loss exhibit is the same as giving two quarts of gin and a sharp straight razor to a 'nigger'; then sending him to a dance".

Also there are those susceptible to salesmanship. One adept in the art of convincing others can make some believe that two plus two equals five, or at least four and a half. Reverting to the political horizon, we have a dreary sample of this type of interpretation with the Republican Party trying to sell its conception of the National Debt and the Democratic Party hammering away with an entirely different explanation. Interpretation can be flavored by salesmanship and propaganda. Figures can be twisted to substantiate a desired conclusion. However, as sixty-six per cent. of the square root of npq gives the probable deviation between the blushes and feathers of a flipped two bits, we are safe then, unless someone steals the coin.

In dealing with statistics, the interpretation of the data collected is more important than the data itself. We must look beyond statistics. They, after all, represent an outward and visible sign indicative of which way the wind blows. The wind itself is the important thing. Whither does it list? The experienced mariner never needed a weather vane to show the direction of the wind, nor did he look "through the large end of a telescope" to determine the "importance of what lay ahead". Many forces lie behind life insurance statistics. We must know these forces and their portent to properly interpret our statistics. And even then, like the dog which feared he smelled something direful up wind, we will probably be wrong.

It may be amusing to Mr. Larus, but unfair to his studies, to dismiss his efforts with venial generalities. Statistics, supposedly exact, and Mr. Larus' comments, undoubtedly authoritative, both warrant a discussion and not a discussive. Mr. Larus has indulged himself in some quoted words and freely given a formula which are as far over our heads as a stratosphere gondola. He assumes we know more than we do, neglecting to teach us the A, B, C's, but giving us the npq's, complicated by fractions. Would he mind, and would you object to hearing a word or two from the primary reader? They emanate from those who know their figures,

reflect no personal accomplishment, and may be a complement to Mr. Larus' thesis, dealing as it does with important and valuable particulars rather than with generalities.

Statistics are data obtained from enumeration and measurement of group aggregates, and the Science of Statistics is the method of analysis and interpretation of statistical data. In a Statistician's investigations, usually the aggregates cannot be examined exhaustively, or the totality is too great for enumeration, so he must resort to selection of samples. It is assumed that the proportion of characters in the sample is the same as that of the aggregate. He employs, in summarizing characters and relationships of the groups, three general types of statistical numbers:

(1) Average numbers—indicative of the central tendencies, comprising the mean, mode, median, etc., of the group.

(2) Dispersion numbers—comprising standard deviation, probable errors and the like, indicative of the variability or "spread" of the group.

(3) Correlation numbers—for measure of significant relationship between different groups.

Much pains must be exercised in the collection of data, and the subsequent derivation of "statistical numbers". Otherwise various fallacies may occur unless prayerful care is taken to guard against bias in the former and misuse of the latter. In the collection of data, the samples should be representative of the aggregate, and the selection truly random, as exemplified by Mr. Larus' "examined by country physicians" example. In social and economic studies, fallacies occur because the information obtained is frequently inaccurate. Allowance should be made for ignorance, vanity or dishonesty of respondents to queries on age, race, salary, expenditures, or physical and mental impairments. Common errors arise from samples through paucity of information or neglect of relevant factors: Of the former, an inference from death rates in two localities without considering the age distribution of the inhabitants; of the latter, an inference that marriage is conducive to longevity because "statistics prove that married men live longer than single"—a difference, if any, may be due to the unwillingness

of the unhealthy to marry; or even the penumbrous fringe of urnism might be explored for another reason. The annual number of births in the United States exceeds the deaths, the population continues to grow and yet one of our valued members proves we are fast approaching race suicide.

In the interpretation of "statistical numbers" it must be remembered their value is for the quantities they typify. They measure the characteristics of the group but say nothing about any one item of the group. Which one of the various measures is pertinent to the study? Does the mean, median or mode best typify the group? The choice of the variability measures must also be carefully considered. Further, does the chosen average represent an invariable relation within the group and can a forecast for other groups be made on the basis of findings in the one investigated? Frequently correlation numbers are not significant of invariable relations between groups because their values may be consistent with more than one interpretation. Is an increase in arrests due to an increase in crime, or a spasmodic severity in law enforcement? Both the dog and wolf are of the genus Canis and both have tails. That of one wags and the other does not; which is not necessarily proof that the wolf is never pleased.

The science of statistics, in spite of some disparaging comments, is an effective tool for the competent, but is liable to unconscious or conscious distortion by the ignorant or wicked.

Many checks should be made of methods and analyses before an interpretation may be considered trustworthy.

1. Are the results reasonable? And, who is doing the interpreting, what are his technical qualifications, his biases, if any, and who pays his salary?

2. Is it possible to reach any other logical conclusion?

3. Can past conditions be a sound basis for future predictions? "What has been, shall be" is apt to be wrong if dealing with the vagaries of the human animal.

4. Is the group of data large enough to solve the problem?

5. Are the methods used applicable to the data, and are the facts sufficiently accurate and complete to justify the methods?

6. Has there been any comparison of non-comparable data? Apples and pineapples cannot be added any more than percentages can be averaged.

7. Are there cumulative errors, or have previous convictions perniciously crept in, or have important factors been left out?

There are many more, but the foregoing seven—a number sacred amongst primitive peoples—may be considered with profit before deciding upon the merits, trustworthiness or accuracy of any interpretation.

Mr. Larus has expressed dramatically some of our quandaries in handling reinstatements, making a distinction between the theoretically unassailable statistical finding, and practicality. Perhaps it may be said that anything which is theoretically feasible is practically so, otherwise there is something wrong with the theory.

The human can be distinguished from the beast, not only by the thumb—which many use for counting purposes—but by the knowledge and use of numbers. Some like to befuddle themselves with statistics; it is a pleasant vice. Others fear numbers because of their absolutism and heartlessness; but, with a sense of humor being a component, the results might be portentous. Women after all are the most rational Statisticians. They count so long—then, with disarming and delightful inconsistency, they stop counting. Statistics bore most people to distraction though they have an envious admiration of a Statistician, even be he "beetle-browed and intense", as he is an interpreter of life. The Sphinx herself may some day lose her inscrutability through his probing.

Dr. Russell—I will ask Mr. Larus to make a few remarks in closing the discussion.

Mr. Larus—The value of this necessarily fragmentary paper has been greatly enhanced by the additions made to it in the discussion. In fact, as I listened to Mr. Maclean I wondered whether his contribution was not more worthy of being called the paper, and mine the contribution.

May I take this opportunity of thanking not only those members who have taken part in the discussion, but also those present

at this meeting for their patience in listening to a paper which even actuaries would hardly consider exciting.

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DR. RUSSELL—The next paper will be presented by Dr. Charles E. Homan, Assistant Medical Director of the Connecticut Mutual Life Insurance Company. This is Dr. Homan's first contribution to our Proceedings. I know we shall all enjoy having his viewpoint regarding this all-important subject.

CHANGING ATTITUDE TOWARD PULMONARY TUBERCULOSIS

By Dr. Charles E. Homan, Jr.
Assistant Medical Director
Connecticut Mutual Life Insurance Company

There has developed a more optimistic attitude toward the underwriting of cases presenting a past history of pulmonary tuberculosis. Inquiry of the members of this Association produced 37 replies. One company did not accept cases presenting this past history. Of the other 36 companies 25 followed the ratings suggested in the M.I.R. Eleven did not follow the suggested ratings; 5 of them using generally lighter ratings, 3 heavier ratings, and 3 using lighter ratings in the older age groups and heavier ratings at the younger ages. However, 25 replied that these cases were treated more liberally than they were 10 years ago. This liberalization was based on mortality investigations in only 3 instances. The material available to me for mortality investigation of this impairment was not sufficient to be of value but your Program Committee felt that since such a large number of Medical Directors had become more liberal in underwriting this impairment in the past 10 years, it might be well to discuss some of the factors that have prompted this underwriting optimism.

In explanation of the change in attitude towards the underwriting of this impairment, answers to the questionnaire mentioned the effectiveness of modern methods of treatment. There are now fewer cases requiring readmission to sanatoria and, since it is a recurrence of tuberculosis that is particularly to be feared in this group, there is some ground for optimism on this score. In those cases which do recur, modern management, particularly the use of collapse therapy, has markedly improved the early prognosis; and, while it has not been used long enough or in sufficient number to be certain, there appears to be a corresponding improvement in the ultimate prognosis. Practically all Medical

Directors stated that they are now able to obtain more information regarding each individual case, and that X-rays had been of particular help. With the development and popularization of sanatorium care, the excellent educational program instituted by the National Tuberculosis Association, and the more frequent use of the X-ray in diagnosis and follow-up examination, we can obtain a much more satisfactory clinical history of the illness; and are able to classify as to the type of lesion, the extent of the lesion, and the severity of the response to infection, and can much more accurately determine the time since arrest. It is the availability of this information which makes it possible to select from the group of cases presenting a past history of pulmonary tuberculosis, those which we may expect to have a more favorable mortality; and it is these factors that I should like to discuss, as clinical investigation has shown them to be related to prognosis.

First, as to type of lesions,[1] the primary infection with tubercle bacilli in practically all instances occurs in childhood and is a caseous pneumonia located, as a rule, in the lower part of the upper lobe or the upper part of the lower lobe near the periphery. Since there is no specific immunity, before the lesion is localized the bacilli have passed to the glands draining the area. In these glands the response is much more marked and entirely out of proportion to the size of the lesion in the lung. In favorable cases the original lesion heals by a process of encapsulation, fibrosis, and calcification, and ossification of the lesion is not an infrequent outcome. The fluid contents of the glands are gradually absorbed, the lesion healing by a process of fibrosis and calcification. This original infection produces the small rounded lesion so frequently seen in X-rays of the lung called the Ghon Tubercule, and the calcification of the lymph nodes associated with it. For insurance purposes this lesion need not be considered. In some instances when the original lesion is small it may become so completely fibrosed that it is not visible in X-ray plates. The original infection may occur outside of the lungs, a percentage of cases variously estimated to be from 3% to 16% occurring in the gastro-intestinal tract.

Secondary infections are most frequently apical, located in or immediately below the apex. There are various explanations of this localization, none of which is entirely satisfactory. Not only do these secondary infections differ in location from primary infections, but, due to the immunity developing as a result of the primary infection, there is a marked tendency of the tissues to localize the lesion so that enlargement of the lymphatic glands is not a part of the picture in these infections. The character of the reaction is a mixture of three pathological pictures:—the destruction associated with the presence of the bacilli, a productive type of lesion which is responsible for the localization of the lesion, and also an exudative component due to a hypersensitization to tuberculin. It was previously thought that this allergic response was quite helpful in walling off the infected area, but recent investigations[2] have apparently demonstrated that allergy and immunity are two separate reactions and that immunity may be retained when the body is desensitized to tuberculin. As a matter of fact, it is now evident that the productive type of lesion is much more benign than the lesions with large amounts of exudate since in numerous cases this intense allergic response is sufficient to cause destruction of lung tissue and results in cavitation. It is relatively uncommon to have a tuberculous lesion either purely an exudative or purely a productive type of lesion. The combination of these two types is a much more frequent finding.

However, if absorption of the exudate and healing occur without cavity formation, the end result in the two types is the same and depends on the amount of permanent tissue damage. Cavity formation, as we all know, increases the seriousness of the case to such a degree that its persistence makes it unwise for us to consider it. A report by Barnes of 214 cases[3], followed from 5 to 14 years after diagnosis was made, shows the relative results to be expected in various types of lesions. In this group his deaths in the productive type of lesion were 17%, in the mixed types 23%, and in the exudative type of lesion 39%.

In addition to the type of infection the severity of the response of the body to infection bears a relationship to prognosis. With the frequent use of X-rays we quite often see cases in which

the end results of the healed lesion are seen, and in these applicants there is no past history of pulmonary disease. This silent lesion, when found in individuals of forty years of age or over and the character of the lesion indicates that it is well-healed, rarely gives further trouble. This was discussed before the Association by Dr. McPhedran[4]. These lesions occurred in the period when knowledge of the early cases of tuberculosis, and laboratory aids were not as satisfactory as they are at the present date. A number of these cases are now diagnosed as pulmonary tuberculosis[5] because we appreciate that a cold which apparently lasts for a few weeks, or some feeling of lassitude apparently of minor importance and from which the patient spontaneously recovers, may be all of the symptoms associated with a tubercular infection.

We also are aware that cases with constitutional symptoms are more likely to have extensive lesions and destruction of the tissues producing cavity formation. In cases of minimal involvement the eventual outcome is much more favorable in those with little or no evidence of fever, increased pulse rate, or weight loss; and sanatorium results show that minimal cases able to be discharged in a period of less than six months have a much more favorable prognosis than those requiring a longer stay. In cases of greater involvement we find that generally the longer the stay in the sanatorium the better the results, although in this group those whose symptoms are mild are much more favorable than those with severe symptoms.

It is increasingly evident that the eventual prognosis depends to a large degree upon the extent of the disease. A simple classification used by the National Tuberculosis Association divides cases according to the extent of involvement into:

Minimal Cases

(A) Slight infiltration without demonstrable excavation.

(B) A small part of one or both lungs—Total volume of involvement, regardless of distribution, shall not exceed the equivalent of the volume of lung tissue which lies above the second chondrosternal junction and the spine of the fourth or body of the fifth thoracic vertebra on one side.

Moderately Advanced Lesion allowable under Moderately-Advanced—one or both lungs may be involved, but the total involvement shall not exceed the following limits:

(A) Slight disseminated infiltration or fibrosis which may extend through not more than the equivalent of the volume of one lung.

(B) Severe infiltration, with or without fibrosis, which may extend through not more than the equivalent of one-third the volume of one lung.

(C) Any gradation within the above limits.

(D) Total diameter of cavities, if present, should not exceed 4 cms.

Far Advanced A lesion more extensive than under Moderately-Advanced. Or definite evidence of greater cavity formation.

The marked difference in mortality in these classifications can be best illustrated by reports comparing the end results of sanatorium cases falling in the different classifications. Before this Association in 1928 Knight and Dublin reported the results of study of cases discharged from the Metropolitan Life Insurance Company Sanatorium from 1914 to 1926.[6] Of 833 patients admitted in the incipient state the mortality was 129%. By sex the mortality in this group was 98% for males as compared with 209% for females. These results are striking when we appreciate that this expectancy was obtained in cases of active pulmonary tuberculosis and not in arrested cases. The moderately-advanced group, 509 in number, show 115 deaths as against 20.9 expected, a ratio of 548%. Again, we must appreciate that this was the experience in cases with active tuberculosis and 79 of the cases were discharged from the sanatorium unimproved. In the far-advanced cases the group was small, the ratio of actual to expected being 1698%. Practically all sanatoria are now taking an active interest in follow-up results which, as a rule, are reported as the percentage of discharged cases dead at the end of the period investigated regardless of condition on discharge. These reports have no direct application to underwriting. However, the results in the various

classifications are of interest. The New Jersey State Sanatorium from 1907 to 1928 had discharged 8,683 cases[7]. At the end of the period, of 2,490 minimal cases 16.42% of this group with negative sputum were dead. With the same degree of involvement but a positive sputum 32.08% were dead. 4,322 were classified as moderately-advanced and 29.4% of this group with negative sputum had died. Of those with positive sputum 60.66% had died. In the far-advanced group the percentages were 72.2 and 87.9. In the 1934 meeting Dr. Fellows brought to your attention the report by Langmuir, Williams & Pope[8], a follow-up of 398 cases from 1925 to 1931, showing that in the minimal cases 17% died; of the moderately-advanced 41%; of the far-advanced 79%. They also noted more favorable results in cases with negative sputum.

[9]The Saskatchewan Sanatorium results have been reported on two occasions. The last report of 2,031 cases, followed from 1 to 13 years, showed 9.49% of minimal cases dead with negative sputum, and 13.16% with positive sputum. In the moderately-advanced the corresponding results were 14.8% and 37.89%; and 30.35% and 59.94% in the far-advanced.

The Trudeau Sanatorium report[10] of cases discharged from 1916 to 1930 showed the following percentages dead: At the end of the 5 years, minimal 4.6%, moderately-advanced 12.7%, far-advanced 46.6%; at the end of the 10 year period, 6.8%, 18%, and 54.7%; at the end of the 15 year period, 7.3%, 19.4%, and 56.8%.

A review of other reports[11] only confirms the fact, that to attempt to estimate the prognosis of a case of tuberculosis, the degree of involvement must be taken into consideration. Roughly, cases in the minimal and moderately-advanced groups had twice as many deaths if the sputum was positive for bacilli tuberculosis as cases of the same group with a negative sputum. The moderately-advanced group had twice the percentage of deaths as those with minimal involvement. We, of course, appreciate that these results are in cases discharged regardless of the condition at the time of discharge. A sufficient following-up of cases has not been reported to tell whether this ratio would hold for cases

arrested at the time of discharge. In my opinion, based entirely on clinical experience, I would expect a much greater difference in the minimal and moderately-advanced groups.

There are numerous other more or less measurable factors influencing prognosis. The time since arrest, age, and weight were investigated in the Medical Impairment Study of 1929. Other factors as sex, economic status, race, and occupation are available for study. It is evident, however, that the extent of the lesion and the presence or absence of tubercle bacilli in the sputum determine to a large extent the end result. It would seem wise to so arrange our material that these factors can be investigated in future studies. With the availablity of reports from private physicians, sanatoria, and original X-ray plates, it should not be difficult to classify these cases using a simple classification such as that of the National Tuberculosis Association, the degree of involvement being designated in our records by appropriate symbols. It is only by investigating these classifications that we can satisfactorily determine whether the present day optimism is justified.

1. Jaffe, Richard H.: The Pathology of Pulmonary Tuberculosis; Goldberg: Clinical Tuberculosis, Philadelphia, F. A. Davis, 1935.
2. Rich, A. R.: The Role of Allergy in Tuberculosis, Arch. Int. Med. 43:691, (May) 1929.
   Rich, A. R., and McCordock, Howard A.: An Enquiry Concerning the Role of Allergy, Immunity and other Factors of Importance in the Pathogenesis of Human Tuberculosis, Bul. Johns Hopkins Hosp., 44:273, (May) 1929.
   Rich, A. R.: Observation on the Relation of Allergy to Immunity, Bul. Johns Hopkins Hosp., 47:189, (Oct.) 1930.
   Rich, A. R., and Margaret Reed Lewis: The Nature of Allergic Tuberculosis as Revealed Extensive Culture Studies, Bul. Johns Hopkins Hosp., 50:115, (Feb.) 1932.
3. Barnes, Harry Lee: Prognosis of Non-Cavernous Phthisis, Amer. Rev. Tuber., 28:660, (Nov.) 1933.
4. McPhedran, Maurice: X-ray Evidence in the Evaluation of Pulmonary Lesions in Life Insurance Medicine, Proceedings of Life Insurance Medical Directors of Amer., 21:237, 1934.
5. Amberson, J. Burns, Jr., and Riggins, H. McLeod: Tuberculosis Among Student Nurses, a Five Year Study at Bellevue Hospital, Annals of Int. Med., 10:156 (Aug.) 1936.
6. Knight, Augustus S., and Louis I. Dublin, Mortality, Morbidity and Working Capacity of Tuberculosis Patients After Discharge from the Metropolitan Life Insurance Company Sanatorium

between 1914 and 1927, Proceedings of Life Ins. Med. Directors of Amer., 15:247, 1928.

7. English, S. B.: Subsequent history of 10,515 tuberculous patients discharged from State Sanatorium at Glen Gardner between November, 1907, and June 30, 1928, J. M. Soc. New Jersey, 26:711-718 (Nov.) 1929.
8. Langmuir, Williams and Pope: Certain Factors Influencing the Mortality of Sanatorium Treated Cases of Pulmonary Tuberculosis, New England Journal of Med., 211:26 (July 5) 1934.
9. Wherrett, G. J.: Follow-up information in 2,031 tuberculosis patients one to thirteen years after discharged from Sanatoria, Amer. Rev. Tuberculosis 31:62-73 (Jan.) 1935.
10. Heise, Fred H. and Hennigar, William A. P.: The Condition in 1931 of Patients Discharged from the Trudeau Sanatorium from 1916-1930, Tubercle, 15:120 (Dec.) 1933.
11. Heise, Fred H., and Brown, Lawrason: The Present Condition of Patients Discharged From the Trudeau Sanatorium, 6:227-233, Tubercle, 1925.

Whitney and Myers: Post Sanatorium Histories of Tuberculosis Cases, Amer. Rev. of Tuberculosis, 21:691, (May) 1930.

Whitney, Jezamine S.: Post Sanatorium Histories of Tuberculosis Cases, Amer. Rev. of Tuberculosis XXI, 691-701 (May) 1930.

Lawrence, William F.: What happens to patients discharged from tuberculosis Sanatoria, National Tuberculosis Association, (January) 1933.

Spector, H. I.: Prognosis in Arrested Tuberculosis, Diseases of the Chest, 11:22 (May) 1936.

Dr. Russell—The discussion will be opened by Dr. Lauritz S. Ylvisaker, Associate Medical Director of the Prudential Insurance Company of America.

Dr. Ylvisaker—The declining death rate from tuberculosis (see Figure I), which has been continuing for the last fifty years and which reached its lowest figure—56.6 deaths per 100,000 of population—in 1934, represents one of the most remarkable achievements in the history of preventive medicine. This record stands as a splendid tribute to the work of those who have contributed to our knowledge regarding the cause and the nature of the tuberculous process, and its diagnosis, treatment, and prevention. It has been an encouragement to those who, under the leadership of the National Tuberculosis Association, have been directing the program of prevention. It should inspire us with the determination to use our influence to throw the power of the insurance world behind the forces which are aligned to stamp out this dread disease.

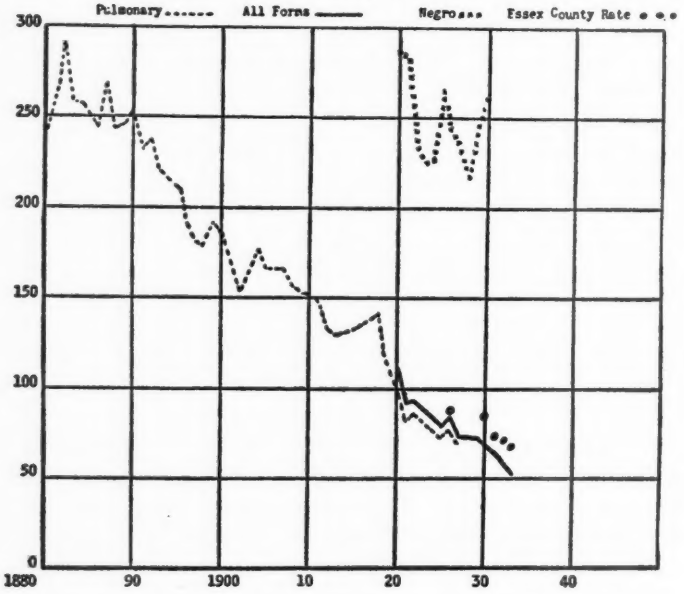
The campaign of prevention is in full swing. With the confidence which only past successes based on real knowledge of a situation can give, the program for the future has been outlined and set in motion. Everywhere children are being examined in order to determine, with the aid of the tuberculin test, the ones who have and those who have not been infected. Those who have had their first infection are being observed through their childhood and early adult years and examined further with chest X-rays,

FIGURE I.

Courtesy of the Essex County (N. J.) Tuberculosis League

TUBERCULOSIS IN NEW JERSEY

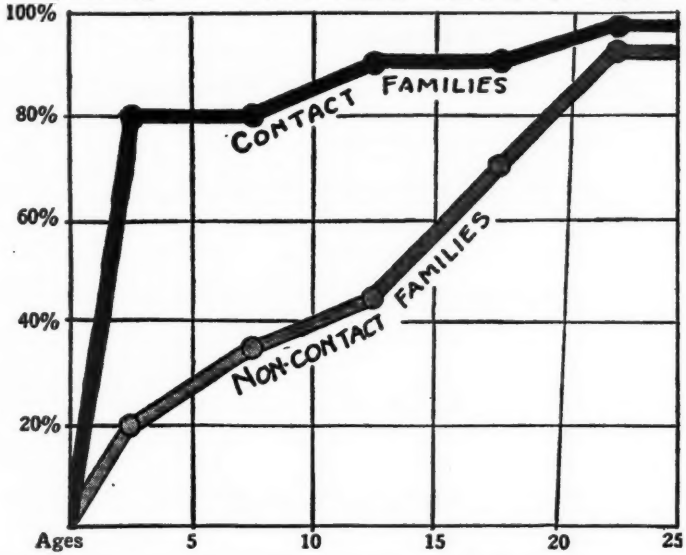
Death Rates Per 100,000 Population



when indicated, in order to detect as early as possible the second infection, when and if it should appear. Those with these early lesions are being given immediate and effective treatment. Searches

are being made for the open cases which may have infected the positive reactor. Those with a positive sputum are being isolated in sanatoria to prevent the spread of infection. Investigations of

FIGURE II.
Courtesy of National Tuberculosis Association
TUBERCULIN REACTIONS
(Indicating Infection—Not Necessarily Disease) by Age Groups



this type are being made of public school children, high school, college, and university students, nurses, medical students, applicants for employment and employees in business and industrial concerns, and all private individuals who develop any suggestive manifestations of the disease.

As a result, a wealth of new information is being brought to us through our insurance applicants. In the main this information is definite and reliable, and presented to us according to the classification accepted by the National Tuberculosis Association and

published by them in their Diagnostic Standards. This new information will undoubtedly facilitate and make more accurate our selection of applicants. At the same time it brings with it a new responsibility, that of applying this information correctly to our selection problems. There is danger in all new information. We can fail to use it, or we can abuse and misapply its teachings. We see daily illustrations of errors resulting from a lack of understanding of these newer developments. A doctor came to our Home Office recently, indignant because we inquired why his patient was considered disabled because of the presence only of a "spot" on his lungs, the calcified nodule from an old healed primary lesion. Another physician was equally aroused when we inquired why his patient was considered to have an active tuberculosis because of the presence only of a fairly positive tuberculin reaction.

As a result of the investigations which are being made, our applicants are being definitely classified. We are told that they have not been infected—are non-tuberculous—or that they have been infected—are tuberculous. If infected, we are informed that they have had their first (primary or childhood) infection only, or that they have developed a second (adult or re-) infection. If they have developed this second infection—clinical disease—we are told whether they have minimal, moderately advanced, or far advanced lesions.

We can best appreciate the significance to us of the non-tuberculous classification when we recall that less than 25 years ago it was accepted that every child had been infected before attaining the age of five years. Today, that is true only of those children who have been so unfortunate as to be exposed to a relative or attendant with an open lesion. Children who are enjoying the protection provided by present-day prevention methods are either remaining free from infection throughout life, or are becoming infected at a much later age (see Figure II). It is estimated that about 20% of the population in this country today remain uninfected throughout life. The relative proportion of uninfected to infected will surely grow as prevention becomes even more effective. The differential diagnosis between the non-tuberculous and tuberculous will grow in importance accordingly.

The line between the two groups is definitely drawn. Except in rare known instances, it is accepted today that those who have a negative response to a properly performed intradermal tuberculin test have never been infected by the tubercle bacillus. This fact is so well established that X-rays of the chest are not usually considered indicated when the tuberculin test is negative. It is likewise accepted that a positive reaction indicates definitely that the individual has had his first infection. The degree of the reaction is in no wise to be interpreted as an indication of the type of infection, or of the extent or activity of a second infection (clinical tuberculosis).

In one of the largest New York City hospitals between fifteen and twenty thousand patients have been admitted to the tuberculosis service during the last five years for investigation by accepted methods. Between 15% and 20% of these have been discharged as definitely non-tuberculous. Everywhere the same procedures are being followed with comparable results. The results are reflected in our work as shown by the following cases:

I

A male applicant, 16 years of age, reported to our examiner that he had been in a tuberculosis sanatorium during the preceding year. The examiner accepted this information as a definite history of tuberculosis and on this basis the application was declined. In response to our action we received a statement from the Tuberculosis Division of the Pennsylvania Department of Health to the effect that the applicant was admitted for observation because a school nurse had noticed that he was underweight and coughing. He was subjected to the usual investigation, including repeated Mantoux tests with increasing doses of tuberculin according to accepted methods. All were negative. He was discharged as non-tuberculous.

II

A brother of the above applicant applied simultaneously and was declined because he was living with one who had tuberculosis.

III

A male applicant, 18 years of age, reported that he had been ill the year before with a cough and a blood-streaked sputum. The examiner could not exclude a tuberculosis on the basis of the information given him. The application was, therefore, declined. Our action brought a reply from the tuberculosis section of the Ontario Board of Health to the effect that the applicant had been subjected to the usual line of investigation shortly after his illness a year ago and that all examinations, including his tuberculin test, were negative. He was discharged with no evidence of tuberculosis.

IV

A male applicant, 24 years of age, reported that his father had died of tuberculosis. Physical examination was negative except for an underweight. According to the medical impairment ratings for family history of tuberculosis and underweight, he could secure insurance only at a rating well above standard. The policy was issued at this rating. Our action brought a reply from the Tuberculosis Department of the University of Minnesota to the effect that the applicant had been studied carefully, that all tests including the Mantoux and chest X-ray were negative, and that he was no longer in contact with one who had an open lesion.

With this information all four applicants were accepted; and instead of being classified with the unfavorable tuberculous groups, they were really preferred risks, because we knew that they had not even their first tuberculous infection.

Dr. Homan has described the tuberculous process fully to us and has explained how it enters the body in the so-called first infection (childhood or primary type) causing a definite lesion in the lung which may be only microscopic in size, or which may assume macroscopic proportions and be very evident on an X-ray film. The first infection usually causes no symptoms; is followed in three to six weeks with a change from a negative to a positive tuberculin reaction, and clears in a relatively short time, leaving no X-ray residual except for a few calcified nodules in a small

percentage of those infected. This first infection today affects about 80% of the population, *without causing death* except in relatively few instances where, in a child, a massive virulent infection breaks down the local lung resistance and is carried on by the blood stream, with the resulting development of a tuberculous meningitis, miliary tuberculosis, or massive lung involvement, which are almost invariably fatal. It furthermore *causes no disability* except in comparatively few instances when, in similar manner, it invades bones and joints with the well-known complications in these locations.

Dr. Homan has also described the second infection and has explained to us how it progresses, causing *minimal lesions,* limited to an area equivalent to that above the second rib, and without demonstrable cavity formation; *moderately advanced lesions,* involving the equivalent of an entire lung, or causing cavities not exceeding 4 cms. in diameter; and *far advanced lesions,* involving more than the equivalent of one lung or causing cavities exceeding 4 cms. in diameter; all of which lesions in 1934 involved about 1% of the population, caused 71,000 deaths, more than half a million cases of total disability, and several hundred thousand cases of partial disability.

It is difficult to understand how the same infectious agent can have such varying effects on life and health as occur in the first and second infections. This fact seems well established, however, and it is our responsibility to say when the first stage ends and the second begins, and to appraise that distinction in dollars and cents. The task is not a simple one, because the line between the first and second infections has not been definitely drawn.

In our insurance selection work, however, when we have two groups with such varying effect on both life and health, we often find it expedient and imperative to draw an imaginary line on the basis of what is known, and then proceed to use that line until it stands or falls in the light of our mortality experience. From the standpoint of objective findings, on which we are so dependent, we can construct such a line of demarcation between the first and second infections by establishing, as our diagnostic criteria for the first infection group, a positive tuberculin reaction and

a negative chest X-ray film; and, as the criteria for the second infection, a positive tuberculin and a positive X-ray film. It is becoming increasingly evident that a diagnosis of clinical tuberculosis without X-ray evidence of a parenchymal lung lesion is no longer tenable. Dr. Lawrason Brown has indicated the trend in this direction when he reported that 16% of the patients came to Trudeau 20 years ago without X-ray lesions, whereas 4 years ago only 4% came without X-ray findings. That percentage has undoubtedly dropped since, and I think we can safely predict that it will drop to almost zero.

Dr. Brown reports having followed for a period of from 1 to 7 years, 264 patients who had been referred for observation and treatment, who had negative chest films and none of the five diagnostic criteria of clinical tuberculosis. Only two—less than 1%—developed lesions of the reinfection type. In another group of 298 patients with negative chest films, only two—again less than 1%—developed reinfection lesions. In a third group of 312 patients who had negative chest films, which included 76 who gave a history of hemoptysis and 28 who gave a history of pleural effusion, only two died of reinfection lesions. Dr. Brown in 1934 summarized his experiences by stating, "We feel that, if by the age of 23 there are no parenchymatous changes in the lungs suggestive of pulmonary tuberculosis, only in rare instances—and then, usually only when subjected to repeated and continuous infection—will the individual develop pulmonary tuberculosis."

Neither Dr. Brown nor we would want to leave the impression, with such a statement, that clinical tuberculosis does not develop in the upper ages. We know that reinfection lesions can develop at any age; but it is helpful to us in our work to know that there is less likelihood of the disease developing after the early adult years in one who has a negative film. There will always be those who will inquire whether some individuals may not have lesions below the threshhold of visibility in an X-ray film, which will eventually cause disability and death. Anything is possible, but is it not our function to concern ourselves with measurable probabilities rather than mere possibilities? We know that under present-day conditions about 1% of the population will develop

reinfection lesions. We shall naturally have to continue to apply our ordinary underwriting principles in order to anticipate as far as possible those who will most probably develop clinical tuberculosis, but we cannot predict who of those who have had their first infection will go on to their second infection.

The occurrence of these second infections, therefore, represents one of the expected uncertainties in life which our standard premiums are designed to cover. Dr. Amberson of New York City has proved for us that we cannot go beyond our knowledge of the cause, the contact with, and resistance to the tuberculous infection and predict specifically who will develop clinical tuberculosis. He has recently completed a five-year survey of over five hundred nurses in a local hospital. Among 591 candidates examined, seven, representing a little over 1%, were rejected because of existing tuberculous lesions of the reinfection type. Those retained for training were accepted only after the most exhaustive studies. They were followed very closely with X-rays every six months. Repeated tuberculin tests were made on the negative reactors. Over a five-year period, six—about 1%—developed reinfection lung lesions. The records of these six were subsequently studied, and nothing was found in previous X-rays, tuberculin tests, or in their conditions otherwise which would have allowed anyone to predict that they would develop pulmonary tuberculosis. If it was impossible after such complete studies to pick out those who would develop tuberculosis, it would not seem that we can expect to have any better success on the basis of our insurance examinations.

Dr. Amberson made another interesting observation. He divided this same group of nurses into two classes; those who had a negative, and those who had a positive reaction to tuberculin, and he carefully compared the health of the two groups during their period of training. No difference was noted. We should, therefore, be able to conclude that the group who have had their first infection and who have a positive tuberculin but negative chest X-rays are standard risks, even though we know that 1% of them, under present-day conditions, will develop clinical tuberculosis. If we could adopt the above-mentioned diagnostic criteria

for this group, a positive tuberculin and a negative chest X-ray, we would undoubtedly be able to treat more fairly those applicants who have been subjected to errors in diagnosis.

A diagnosis of clinical tuberculosis is still being made on the basis of loss of weight or a tired feeling, and where such errors are made, we need to have our own criteria by which to judge them. We recently received an application from a physician in the Middle West. He reported that he went through his four years in medical school with highest honors, worked his way through school, took his master's degree, and at the end of the four years he was tired. He had none of the cardinal symptoms or signs of tuberculosis, but he was sent to a sanatorium in Colorado and kept there without further developments for a year, as a "tuberculosis suspect", a diagnosis which has wrecked the lives of many; a diagnosis which, with present-day methods, is no longer tenable, and which I hope that we, in insurance circles, will no longer foster. He has submitted X-ray films taken on admission, and others taken since, together with current films. All are thoroughly negative. On the basis of his *history* of tuberculosis he can obtain insurance only at our highest medical impairment ratings. On the basis of such criteria as we would now establish he is eligible for insurance at standard rates. Which is right?

Emphasis has purposely been placed on the application of our information as it pertains to our problems with the non-tuberculous and those of the tuberculous group who have had their first infection, because these groups comprise approximately 99% of our population and because the members of these two groups are, from the standpoint of tuberculosis, healthy individuals whom we can safely insure. Our first duty is to them, and we owe it to them to see that they are not excluded from the protection which life insurance affords.

Dr. Homan has fully discussed the group of those who have had minimal, moderately advanced, and far advanced second infection lesions, and the factors influencing prognosis as they pertain to this group. When we think that in a group comprising 1% of the population—a little over a million people—we have, on the basis of current estimates, 70,000 deaths annually, over 500,000

totally disabled active cases, several hundred thousand partially disabled from recent active lesions, leaving only a few hundred thousand arrested cases eligible for consideration for insurance, I am sure we cannot be criticized for proceeding cautiously. In view of the extensive involvement present in the far and moderately advanced lesions and the unfavorable mortality reported in the twenty-year follow-up studies from Saranac (where of 557 far advanced cases observed and followed through the period from 1916 to 1935, over 55% were dead; and of 2,749 moderately advanced cases, 20% were dead over the same period), I wonder if any of us has the courage to recommend them as safe risks for insurance at any rating.

The minimal lesions have a more favorable mortality (of 955 cases observed at Saranac, about 8% died during the same period), but even in this group I am sure that we are all agreed that caution is necessary; that we need to take into consideration all the factors in prognosis emphasized by Dr. Homan and previously brought before this Association by Dr. McPhedran and Dr. Fellows, before accepting them in accordance with our medical impairment ratings. We cannot work very long with this group of reinfection lesions before we realize the truth of the statement that the most certain thing about clinical pulmonary tuberculosis is its uncertainty. We have all undoubtedly had the experience of seeing minimal lesions develop into moderately and far advanced lesions. We have also seen minimal and even moderately advanced lesions clear up to the extent that they leave little or no X-ray residual. I hope, however, that no one has had the experiences I have had personally of rendering a favorable opinion on individuals with seemingly well-healed lesions, only to see them develop a hemorrhage or a positive sputum from an active lesion shortly thereafter. We cannot perhaps allow such experiences to influence us too much in our consideration of the group, but they do provide a lesson not easily forgotten.

Discussion of these problems has been based throughout on the supposition that we have the information which chest X-rays provide. Intelligent consideration cannot be given applicants who have tuberculous records without this information. The question,

whether we can afford to have X-rays, is best answered by the question, whether we can afford not to have X-rays, when we know that in this group we may be dealing with those who have a mortality many times beyond our insurable limits. There is no applicant today who has had tuberculosis or any suggestive manifestations of the disease, and who has been under the observation of an intelligent physician, who has not had past or present X-rays which he is glad to provide to prove his insurability when that is questioned. Where the amount of insurance involved warrants more than the usual expenditure for medical examinations, the practice is already established of securing films at our own expense. And we can render a distinct service to those who should have chest films for their own welfare by referring them to their physicians for these examinations before we accept them for insurance.

The classification of the National Tuberculosis Association has been used as a basis for this discussion because it is hoped by many of us that it will be adopted eventually by our Association and that our schedule of ratings will be adjusted to this classification. Our medical impairment ratings today are based altogether on the bare history of tuberculosis, age, height, and weight, without giving consideration to the type and extent of lung involvement, which are such important mortality factors. These ratings could be made much more equitable if adjusted to the accepted classification, and our future statistics based on such a classification would be much more valuable.

In accordance with this accepted classification the entire population of the United States, from a life insurance selection standpoint, can be divided into

1. The NON-TUBERCULOUS, those who have never been infected, representing today slightly less than 20% of the adult population, who can be identified by the fact that they have a negative tuberculin reaction. The mortality in this group is not affected by tuberculosis.

II. The TUBERCULOUS, those who have been infected. This second group is again divided into

1. Those who have had their FIRST INFECTION only, representing today about 80% of the adult population, who can be identified by the fact that they have a positive tuberculin reaction and no demonstrable X-ray lung lesions. The mortality in this group is not appreciably affected by tuberculosis.

2. Those who have had SECOND OR REINFECTIONS (clinical disease), representing today about 1% of the population, who can be identified by the fact that they have a positive tuberculin reaction and demonstrable X-ray lung lesions. Those in this second infection group may, by means of the X-rays, be further classified into the (a) MINIMAL, (b) MODERATELY ADVANCED, and (c) FAR ADVANCED groups. The mortality in this reinfection group is decidedly affected by tuberculosis and in accordance with the extent and type of lung lesion.

DR. RUSSELL—The discussion will now be continued by Dr. Parker M. Cort, Associate Medical Director of the Aetna Life Insurance Company.

DR. CORT—Any discussion of this excellent paper of Dr. Homan would naturally resolve itself into the question, "Has the change in our underwriting attitude toward tuberculosis by insurance companies been justified by our experience?"

Dr. Homan reports that the material has not been sufficient nor available for any extensive mortality investigation. That there has been a change in the underwriting attitude is realized by all. The mortality studies may have lagged behind a greatly improved method of treatment of an impairment that was rapidly diminishing as an insurance problem. This change of attitude has presumably been forced upon us by the greater effectiveness of treatment and by the astonishing improvement in mortality and the diminishing number of re-entries in sanatoria for secondary

breakdowns. Like diphtheria and other communicable diseases, tuberculosis as a morbidity and mortality problem has for many years shown a constant and progressive decline—so much so that it has been predicted by optimistic workers in this field that with the proper application of our present methods of diagnosis and treatment the disease could practically be eliminated.

The reduction in the national death rate from 117 per 100,000 to 65 during the past decade is a commendable demonstration of what can be accomplished through organized medicine and, most fortunately, the greatest reduction has been among the wage-earning classes where the problem of spread and cure is by far the greatest.

The incidence of tuberculosis varies so closely to income that it is often called the "Poverty Disease". The high percentage of the disease among the industrial classes or the low wage earners makes it a disease peculiarly sensitive to our national prosperity; and while our entire public has been made conscious of the value of early diagnosis and modern treatment, the great improvement in our working and living conditions has had no small part in this decline.

The percentage of the large Negro population has introduced with us the factor of race but, in the main, we can reasonably anticipate a declining incidence of the disease as our national economic condition improves; therefore, the disease, in numbers, will be less frequently presented as an underwriting problem to insurance underwriters.

The actual problem to the insurance underwriter is the likelihood of recurrence, as Dr. Homan has so well pointed out. There is to be found some comfort in the records of sanatoria that readmissions and recurrences of the disease are declining each year. This would suggest that whenever, after modern treatment, the condition is once arrested, one has a better chance of remaining cured than he did twenty years ago. Unquestionably this is dependent upon a better knowledge and classification of the disease to be combatted; also on an earlier detection and a prompter application of suitable and modern methods of treatment; but it is

also in part dependent upon the kind of life that the subject returns to after his cure.

All sanatorium reports emphasize that the relationship between the stage of the disease at the time of admission to a sanatorium or the time treatment is begun and the subsequent course of the disease is most important in effecting a complete and lasting cure. The widespread mortality between the minimal and the advanced groups demonstrates how formidable is the likelihood of cure.

This relationship of stage of disease to subsequent recovery has been well shown by the experience published by the Rutland State Sanatorium, with 506 selected cases entering in 1925 and 1926 and reported upon in 1934. Of the minimal group 72% were well, 11% were ill, and 17% dead. In the moderately advanced group 44% were well, 15% ill, and 41% dead. Of the advanced group 13% were well, 8% ill, and 79% dead.

In the more advanced group recovery is always associated with the duration of treatment and the mortality will vary inversely with the length of treatment. This is not so true of the minimal types of the disease. Among the minimal and the moderately advanced groups, those with the negative sputum or no sputum have usually done better with a lower mortality than those with a positive sputum.

Dr. Trudeau in his study of several hundred X-ray films concludes that most valuable information can be obtained in predicting the trend of expected mortality.

There are certain findings, either by X-ray or from physical examination, that stand out during the activity of the disease as important factors to the underwriter in estimating the seriousness of the past infection. These could be enumerated as follows:

A. The extent of the lung involvement will very greatly influence the prognosis.

B. The prognosis of the exudative type is decidedly more unfavorable than the proliferative type.

C. The formation of a cavity will about double the percentage of death within five years.

D. Cavity cases that show improvement under treatment have approximately five times as favorable prognosis as those in which the cavity increases.

The American Sanatoria Association has set up a classification of diseases that has clarified our understanding of the extent and type of process:

A. The minimal lesion represents a disease above the second rib on one side or no more than half of this area if both tops are affected.

B. The moderately advanced is infiltration of one lung or a consolidation of one lobe or a cavity up to 4 cm.

C. The advanced type will be all who have greater lesions than the preceding.

CONCLUSIONS: The fact that there has been a change in underwriting attitude toward applicants who have had tuberculosis is justified since tuberculosis as a disease is disappearing as an important factor in American life. This is in large part due to the high plane of our living and working conditions, together with the successful organization of medical diagnosis and care.

In view of the declining number of readmissions to tubercular sanatoria and of the encouraging reports from sanatorium workers of an increasing evidence of permanent cures among a diminishing number of affected, it has now become a reasonable presumption that if a case is well and at work at the end of five years, he will probably be working at the end of ten years.

The minimal type with modern treatment as a group offers an excellent mortality.

While the moderately advanced group shows a somewhat less favorable mortality, yet about 40% of them are shown to recover.

Medical Directors of today have available information that permits them to select their cases with care. More complete data is supplied by our applicants which enables us to determine the type and the extent of the pulmonary lesion. The duration and completeness of treatment are factors that must always enter into our consideration. With the universal and more liberal employ-

ment of X-rays the underwriter is better able to determine the extent of disease and the completeness of the cure. History records now supplied from sanatoria assist us in determining the duration of the disease, the type of treatment employed, and the severity and extent of the pathology. All underwriting today should be based upon complete reports and great consideration should be given to the type and stage of the disease.

Other factors, such as age, race, occupation, and environment, should be considerations as well as type, extent, and duration of the disease; but the underwriting of tubercular risks for the future should be sufficiently elastic to enable the medical underwriter conversant with this disease, after establishing the severity of the old process, to determine the rating or the suitability of the risk.

DR. RUSSELL—I really think that this is one subject that should be thoroughly discussed and I would like to hear from some of the other members and guests.

DR. DUBLIN—Mr. Chairman, I feel a very distinct urge to add a word to the discussion of this subject. As you know, I have lived for pretty nearly thirty years in the atmosphere of our business. I, therefore, have a certain amount of familiarity with the standpoint of the underwriter. Very fortunately I have at the same time kept in close touch with the public health movement, with the work of the national agencies which have addressed themselves to this problem of tuberculosis and which have brought about the situation that has been described by the several speakers.

I say to you deliberately, not on the spur of the moment, but deliberately, seeing the situation from both angles, living as I do in the insurance business and keeping *en rapport* with the situation as it is developing in the tuberculosis field, that we in the insurance business are not realistic in our attitude toward the problem of tuberculosis. I am convinced that we can afford to be much more liberal in our handling of tuberculosis than even the most liberal company is today.

Now that looks like a fairly good sized order but if the Chairman will give me a minute or two, I think I can convince you of the general accuracy of what I am saying. The situation with

regard to tuberculosis is a good lot better than the crude figures would seem to indicate. I have been saying for a good many years now that the problem of tuberculosis will vanish with us, and I say that deliberately on this platform. The cards are all on the table. There are several states in our Union where the rate from tuberculosis is between 20 and 30 per 100,000; that is, where tuberculosis is now a minor cause of death. The number of these states is constantly increasing. Today, in many of the states there are more deaths from diabetes than from tuberculosis, among women.

Our tuberculosis problem is concentrated in a few places. Where are these places? Fortunately for us in the insurance business, the problem of tuberculosis is largely concentrated among our Negroes where the rate is four times what it is among whites. When you are talking of Ordinary insurance, you are not talking of that group, for the most part. Nor is the problem limited to the Negro. Tuberculosis is concentrated in certain occupational groups, where the rate is from three to ten times what it is in the general population. Tuberculosis is concentrated in certain age periods and we know what those age periods are.

What is the meaning of all this? The problem is made infinitely easier for us in connection with our Ordinary business. Moreover we are dealing, not with a worsening condition, but with one which is constantly improving. In other words, we who are engaged in writing long-term contracts have everything to gain and nothing to lose from an attitude of liberality because we shall hardly be able to catch up, in our changing attitude, with the constantly improving situation.

Now what am I proposing? Insure advanced cases of tuberculosis? I should be mad to make any such recommendation; of course, not! That is not where the problem is, however. As practical men, the problem, as I see it, concentrates in two definite situations which come before you as medical directors in passing on specific applications.

One situation is the case of the individual who has a presumptive tuberculous history but who may not have had tuberculosis at all. As the speaker pointed out, that applicant is a better risk

than the general run of the community because he has been proved negative. He is one of those unfortunate people who was suspected, with injury to his own record, but who has been proved to be a negative case. But more interesting than that individual is the one who comes to you with a family history of tuberculosis. The family history points back, the life points forward. Yet, what has been our attitude with regard to the individual with a family history of tuberculosis? It has been an attitude of skepticism and fear, has it not? It has been an attitude of "Beware".

Now I say to you, again deliberately, that the family history in tuberculosis cuts no ice. The family history in tuberculosis can be wiped off the slate without costing us a penny. It is not the family history that determines tuberculosis; it is actual contact that determines tuberculosis. You can see the worst family history you please, find out to what extent that individual has been exposed, whether there is an open case in his family to which he has been exposed, and that has infinitely more significance than a paper family history, which means nothing at all.

The work of thirty years ago which poisoned the atmosphere—I am talking now of the work of Pearson and his school—was wrong. It was wrong because it made no distinction between so-called inheritance and very real and very obvious exposure to an open case within the family. That has been cleared up; we know better now.

Have no fear of the tuberculous family history; forget it. Judge the individual on his merits, on his present condition and do not penalize him because of a history of tuberculosis in three members of the family, one being a far-removed uncle. It means nothing.

Then, with regard to the other type of case where there is a history of tuberculosis, an avowed history, not a suspected history (of course, the latter individual should not be penalized at all), where there is a perfectly frank and honest statement of having been in a sanitorium and having taken the cure and the individual presents himself four or five years later, approach him in this new spirit of liberality because it is a reasonable attitude.

Why? Because the evidence now in hand shows clearly that many of these individuals are standard risks.

We have something to say about that. The evidence of certain sanatoria has been referred to. We have a fairly nice little sanatorium at Mount McGregor, which has been in operation for nearly twenty-two years. Several thousand people have gone through that institution. The criteria that were suggested, Mr. President, with regard to the follow-up were criteria that determined our studies of those cases. We have followed up the individuals treated at our sanatorium and we have lost track of very, very few, as cannot be done in most other sanatoria. And what did we find? We found that individuals who were labelled incipient on admission, according to the diagnostic standards of the time, and who were discharged as arrested had a subsequent mortality like the rest of the group of employees of the Metropolitan, which was a mighty good mortality. You have nothing to lose from that type of individual, if he now has no signs of his old tuberculosis.

Mistakes will be made; of course, they will be made. We are not concerned with what turns up in one of a group of 2,000 or 10,000 or 20,000 people. Of course, some of them will turn out to be tuberculous. If we took any group of insured, would not a certain number of them turn up to be tuberculous? Obviously. But you have, in arrested cases who never had more than the minimal infection, a highly selected group who, from the point of view of our present knowledge—not future knowledge—approximate standard mortality, who are largely standard risks and who, in the light of the improvement in the treatment of tuberculosis which has been effected in the last ten or twenty years, present a picture really very much better than the one that I am now referring to, which is a story of the past. That picture does not include pneumothorax and collapse therapy generally. That group did not benefit from that type of treatment, which now dominates the scene. So, if there was reason for a liberal attitude with that group of minimal cases as the result of the experience of twenty years ago, fifteen and ten years ago, what is the picture for the future? Obviously it is very much better.

So, Mr. President, in a word, I would say our attitude of the present is not realistic; it does not gee with the facts. We can afford to be more liberal, especially with certain groups of tuberculous cases which we know very well how to pick.

DR. RUSSELL—Dr. Muhlberg, would you like to make a few remarks? We should appreciate it very much.

DR. MUHLBERG—I happen to be a member of the Board of Health of Cincinnati. We have a very unfavorable mortality from tuberculosis in our city. Our white rate is about 60 per 100,000 and our colored rate is 480 per 100,000—eight times that of the white race. We have a serious problem because Cincinnati is situated in a valley. We find that the mortality rate from tuberculosis is very high in the valley, but comparatively favorable on the hilltops.

Furthermore (and this is a rather astounding fact that carries out and confirms the idea expressed by Dr. Cort) the economic conditions have much to do with the incidence and death rate in tuberculosis. Our colored death rate from tuberculosis in the valley is pretty nearly 600 per 100,000, whereas among those colored people who live on the hilltop, in a somewhat better economic status, the death rate is only slightly higher than the white rate in the city.

Now what are we trying to do? We felt, of course, that something must be done. Accordingly we are carrying out in every way all the recommendations of the Anti-Tuberculosis National Association with reference to education. There is one item of our educational program that I think is very interesting. We have one man in Cincinnati who is not a doctor, Tony Mees. He was formerly a shoemaker. He has organized clubs among the Negro women; he meets them in churches about once or twice a month; he teaches them how to eat and how to improve their hygienic surroundings, and so on. He has in these clubs some 2,000 members and the death rate in those families is almost as good as the death rate among the white population, showing what education can do if it is persisted in.

We have cleaned out, or tried to clean out our slums, and are replacing them with hygienic low-rental apartments. We are encouraging the people to go to the hilltops, but we cannot get them all to go to the hilltops. As for those that must remain in the basin of the city we are trying to do something to improve their housing conditions.

Then, too, in Cincinnati whenever a patient dies of tuberculosis, immediately our nurses are sent to that home and contacts are established, particularly among children. Those children are then told to attend certain Kroger camps, as we call them, one camp for the white children and one for the colored children. The children are there educated to care for themselves, how to eat, and generally we put eight or ten pounds on those youngsters every Summer.

We are doing another thing that I think is very important. The average doctor does not know how to diagnose tuberculosis. He makes a diagnosis when it does not exist and more frequently perhaps he overlooks the diagnosis. So the Board of Health has told every physician in the city, if he has any case where there is the least suspicion of tuberculosis, to send it to our diagnostic health center where we will make a stereoscopic examination of the lungs, which is then interpreted by Dr. Dunham. As a result, we are picking up incipient cases. Formerly we never got a diagnosis of tuberculosis except in the advanced stages. Now we are picking up about one-third of our cases in the incipient stage. Some of those cases, of course, are sent to our sanatorium and there the results, I understand, are very satisfactory.

Then, too, we are attempting a program of rehabilitation. Unfortunately our sanatorium is crowded. If we cannot admit a case immediately, contact is made with our Assistant Health Commissioners. They, together with a nurse and an expert on sanatorium treatment, care for the patient before admission and try to get him or her to the hospital as soon as possible. Necessarily on account of the crowded condition, they have to dismiss cases before they really should be dismissed. These cases, too, are followed up by the nurse and by the Assistant Health Commissioner, and so on.

In the sanatorium among patients that are approaching a recovery, realizing the fact that the occupation plays so large a part in the recurrence of tuberculosis, we are trying to teach patients who otherwise would probably have a prompt recurrence on account of their occupation. We have a special department where rehabilitation and education and another occupation are taught. We have not been doing this longer than a year or two and I do not know what the results are going to be.

I thought perhaps you would be interested in knowing how cities are working on this problem. I really believe that there will be some improvement in our tuberculosis rate as the result of our efforts.

DR. RUSSELL—Dr. Homan, do you care to make a few remarks in closing the discussion?

DR. HOMAN—The problem that we are particularly interested in now is the individual who developed tuberculosis and is now an arrested case. I was glad to hear Dr. Dublin's ideas about the early cases of pulmonary tuberculosis. Of course, the underwriting problem as well as the clinician's immediate problem of a prognosis would be extremely simple if we could get the one thing that is responsible for the prognosis and that is the individual's resistance to tuberculosis. That, of course, is impossible. We, however, have a number of things we know that influence resistance—age, race, weight, occupation, economic status, sex, and one of the big things is the extent of the tuberculosis. In underwriting a case of tuberculosis that is arrested we make a mistake if we blindly apply a schedule of ratings—we must go further than that. The character of the lesion, the severity of his illness and the extent of the lesion must be taken into account. It would be to me absurd to treat two minimal cases alike if one case had fever for three or four days, was in a sanatorium, at the end of two weeks was allowed up and walking around, and the other minimal case with the same amount of involvement required six or eight months to become arrested. That is some index of the man's resistance. The patient who gets an arrest in a short

time and leaves very little residual in his film has resistance which is something that we are trying to measure.

I believe we shall see a larger number of minimal cases, as so many are now detected in the various routine film examinations. The public health people and the National Tuberculosis Association have done an excellent job. I think that the minimal case, arrested for a short time, is a much better risk than formerly believed. I want to express my gratitude to the gentlemen who have discussed the paper.

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DR. RUSSELL—We are fortunate in having with us an outstanding authority on the specialty of X-ray—Dr. W. Edward Chamberlain, Professor of Radiology, Temple University; formerly Professor of Medicine (Radiology), Stanford University. He is an authority on Hodgkin's Disease and on various other medical subjects, especially those associated with radiology. One of his most important contributions is his paper "X-ray Examination of the Sacroiliac Joints." Combining his training as a physician with that of an electrical engineer, he has developed many mechanical innovations at Temple, such as: the Jackson bi-plane fluoroscope; a marking camera for X-ray films; a radiographic fluoroscopic machine for study of the genitourinary tract; a multi-plane fluoroscope for fracture reductions and several high voltage therapy installations.

He is consultant to radiologists and hospitals in installing new equipment. He is crusading for the recognition of radiology as a specialty so that radiologists may enjoy the prestige of other medical consultants. He has served as executive in each of the three national radiological societies. At present he is Chairman of the Board of Chancellors of the American College of Radiology; a past President of the Philadelphia Rœntgen Ray Society.

Note: An interesting paper on Tuberculosis, well worth review, was presented by Dr. Arthur Hunter at the Ninth International Congress of Actuaries in Stockholm, 1930, and may be found in the transactions.

PITFALLS IN X-RAY DIAGNOSIS*

By W. Edward Chamberlain, B. S., M. D.

Most of the "pitfalls" of which we will speak this afternoon, are dependent for their existence upon slip-shod thinking. Today I am conscious of the fact that I am addressing an audience in which "habits of exact thinking" are developed to a high degree. Men do not become Medical Directors of Life Insurance Companies without having first climbed a ladder of severe discipline. This discipline includes rigorous studies in the fields of Statistics, Mathematics and what might be termed the Philosophy of Normal Variation.

We who are charged with the responsibility of teaching in the undergraduate medical schools of America are disturbed by the degree to which our students fail to exhibit "habits of exact thinking". Apparently no "ladder of discipline" has troubled them. The way has been made so easy for them—their path has been so very much the opposite of a "ladder of discipline"—that their thinking is slip-shod; small difficulties become "pitfalls"; they seem never to be able to separate cause and effect; above all they fall into and remain submerged in the greatest of all pitfalls, classically expressed in the words "Post hoc, ergo propter hoc".

What measures are we taking, or can we take, to elevate standards in the medical school and inculcate "habits of exact thinking"? I have my own pet plan for doing this. I would increase the requirements in Physics and Mathematics, both for the premedical years and the years in the medical school, and I would make a passing mark in a fairly rigorous review of Physics, a "sine qua non" for graduation from the Medical School. Only by so doing can we avoid the serious mistake of sending out into medical practice a certain number of men who are incapable of scientific honesty and whose slip-shod methods of thinking are at once a menace to

*From the Department of Radiology, Temple University Medical School and Hospital, Philadelphia.
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their patients and a stumbling block in the path of scientific progress.

We have said that most of the pitfalls with which we will deal this afternoon are dependent for their existence upon slip-shod methods of thinking. Such, for example, is our frequent inability to appreciate the limits to which a certain physical finding or X-ray appearance is able to vary from patient to patient or from normal human being to normal human being, without being an indication of abnormality. For example, because the average man in a regiment of 1,000 soldiers is 5 ft. 10 in. tall we cannot say that every man who is 5 ft. 11 in. tall is abnormally tall or that every man who is shorter than 5 ft. 10 in. is abnormally short. We all admit right away that there is a distribution curve (Fig. 1) and that the man who is taller than the average is not necessarily "too tall" because he is still within the limits of normal variation. This matter needs no emphasis before an audience of life insurance Medical Directors. You do not need to be told that there is no sharp line of distinction between the normal and the abnormal. I like to point out to my medical students that these distribution curves which mean so much to you and so little to the medical man of less rigorous training, can be applied to all manner of body measurements and even to all manner of physiological characteristics. For example, a thousand (or a hundred) normal individuals will exhibit, upon careful study, characteristically shaped "distribution curves" for such diverse physiological and anatomic characteristics as,—systolic blood pressure, albumen-globulin ratio of the blood, ratio of blood calcium to blood phosphorus, height-weight ratio, transverse diameter of heart, ratio between transverse and longitudinal diameters of head, concentration of hemoglobin in the circulating blood and any number of other measurable qualities. I think it is fair to say that all biologic characteristics partake of this tendency to vary within rather wide limits. Many of the pitfalls in X-ray diagnosis are due to the tendency to call everything which deviates from the "average" or supposedly single norm, a definitely abnormal finding.

Some of you must have chanced upon the ridiculous X-ray diagnosis of "gastroptosis", "visceroptosis", etc. The all too common error of ascribing pathological significance to the presence of a stomach or other abdominal viscus in a position lower than the observer expected to find it, results from a combination of two mistakes. The first of these mistakes arises from the fact that our text books of anatomy are based upon the dissection of pickled cadavers with empty viscera, cadavers that were pickled while in the horizontal position. Were we able to completely eradicate the faulty teachings which depend upon the above facts for their current existence, with a substitution of a new topographic anatomy based upon X-ray studies of the living, diagnoses of visceroptosis would be few and far between. The other mistake upon which the erroneous diagnosis of visceroptosis depends, is the one we have referred to above, that of neglecting the wide variability of the normal. More than fifteen years ago I undertook, in concert with my professor of anatomy of undergraduate medical school days, a study of one thousand normal individuals from the standpoint of visceral position[2, 3]. I obtained typical distribution curves with very wide limits of normal variation, as might have been expected (Fig. 1).

The group of "pitfalls" which depend upon the observer's failure to know the normal and failure to appreciate the limits of normal variation, is a large one. We will find ourselves returning to it from time to time. Just now, however, I would like to consider the subject of "artefact".

My physicist, Dr. George C. Henny, has published an interesting article on this subject and I have appended, for the benefit of those of you who may be interested, the bibliographic reference[1]. Dr. Henny started his published article with a well thought out definition of an artefact, "an artefact in a rœntgen film is a marking produced by an agent other than the X-ray through the parts being radiographed". Artefacts may be in "negative phase" (lighter than surrounding areas of the film) or "positive phase" (darker than surrounding areas of the film).

It is customary for the radiologist or his assistant to blame artefacts upon the manufacturer of the X-ray film. It occasionally happens that an error in the manufacture of the film is responsible, but present day films are manufactured with such care and under such carefully standardized conditions that it is safe to assume that an artefact has been caused in the rœntgenologist's laboratory rather than in the factory where the films were manufactured.

Among the more frequent causes of artefacts might be cited such factors as,—faulty storage (excessive moisture and heat in the film storage room, deleterious gases and vapors, chemically active dust particles); exposure to light through carelessness or through breakage of the box in which the films are supposed to be protected from the light; exposure of the films to stray irradiation from X-ray tubes or radium; stimulation of the emulsion of the X-ray film by physical methods such as bending or pressing upon the film; discharge of static electricity along the surface of the emulsion (Fig. 2) due to frictional contact between the film and its paper wrappings or other contacting objects (The commonest cause of this type of artefact is a faulty technique in removing the manufacturer's black paper covering when the atmosphere is low in humidity as in a steam heated dark room.); improperly mixed chemicals in the developing solution; too close a contact between one side of the film and a side of the developing tank during processing; too close a contact between two adjacent films in the developing tank during processing; incomplete agitation of the film when first placed in the developing solution so that small air bubbles remain attached and leave underdeveloped spots at these points; metallic deposits upon the emulsion from failure to keep the hypo bath sufficiently acid; stains and streaks from impurities in the water in which a developing chemical is mixed or from accidental contamination of developing solution; uneven action of the intensifying screens when these are used (intensifying screens may develop thin spots from wear, pits or cracks from injury and serious stains from contact with dark room chemicals); foreign matter may get inside of the cassettes so as to prevent the light from the intensifying screen from acting evenly upon the X-ray film. In

the above list we have by no means exhausted all of the possibilities for the production of artefacts, but we believe that we have mentioned the most important.

In actual practice some of these artefacts have had serious consequences. We have known of instances of peculiar dark smudge marks (static electric discharge) from rubber gloves worn by the dark room technician, being mistaken for foci of metastatic carcinoma in the spine; on more than one occasion, we have noted erroneous diagnoses of bilateral (or unilateral) pleural effusion when the fault lay in the arrangement of the X-ray tube and its container, so that the edge of a circular opening in the lead glass bowl which supports the X-ray tube, had been permitted to cut across the lung fields at the costophrenic angle so as to simulate the presence of fluid. The disquieting thing is to realize how often such artefacts may have led to erroneous interpretations without our ever finding out the mistake. Were we gifted with superhuman intelligence, what could we not discover buried in our files of X-ray films?

We come now to a type of "pitfall" which is due to improper or incomplete preparation of the patient for a given type of X-ray examination. If an opaque enema is administered without first getting the patient's colon emptied by castor oil preparation and fasting, masses of fecal matter remaining in the colon are apt to simulate pedunculated tumors (Fig. 3). Careful work and especially careful observation with the fluoroscope will usually obviate the difficulty, but the trouble is that the radiologist who does this type of colon examination frequently (who frequently examines the colon by opaque enema without proper preparation) sooner or later develops a habit of explaining away apparent defects and he is very apt sooner or later to make the mistake of passing off a real neoplasm as an "artefact". The medical profession is responsible for most of these errors. Too often the physician says "I want an opaque enema examination of such and such a patient at 3 o'clock this afternoon". The rœntgenologist's request for an opportunity to properly prepare the patient is then met by the statement "No, I do not want this patient prepared. I don't see why you always

ask for preparation. You haven't made any mistakes for me by taking patients without preparation. I want the diagnosis this afternoon". So the rœntgenologist goes on preaching that the patient should be properly prepared, but is forced very often to disobey his own rule.

The same reasoning that makes it advisable if not absolutely necessary to have the colon empty before the opaque enema examination, should make it mandatory that the stomach be empty before a gastro-intestinal series is started. In cases of pyloric stenosis it may be impossible to get the stomach entirely empty. Under these circumstances, we are often so handicapped that we can only say "pyloric stenosis" and cannot decide, from the X-ray examination, whether we are dealing with benign or malignant obstruction of the pylorus. In the stomach which is not obstructed, there would seem to be no excuse for making the mistake of calling a food residue "pathological". Nevertheless, I have seen this mistake made. A New England vegetable dinner or a stack of Mr. Child's wheat cakes can certainly simulate a carcinoma of the stomach.

The physical laws which govern the absorption of X-rays by tissues (and matter in general) are such that defects in soft tissues and soft tissue protuberances produce shadows which may lead us far astray. For example, a gaping scalp wound will appear very much like a skull fracture (Fig. 4) because the air contained in the gaping wound permits the passage of sufficient extra X-ray to produce a dark area on the film in sharp contrast to the less dense areas on the film in the adjacent portions (where the soft tissues absorbed the X-rays and prevented the blackening which occurred under the air-containing scalp wound). Similarly, such structures as moles, sebaceous cysts, and normal nipples (Fig. 5) are capable of appearing on the rœntgenogram as "tumor nodules" because the normal layers of air around the protuberances accentuate their shadows by putting them in contrast with darker areas of the film. The relatively soft (non-penetrating) X-rays which are usually used in rœntgenography may be as much as 50% absorbed by a centimetre or so of normal soft tissue. It may thus happen that the

appearance of a tumor nodule is produced by a perfectly normal female nipple if it is the least bit prominent so that it is surrounded by a measurable layer of air (Fig. 5). The same physical laws (governing the absorption of X-rays by matter) are responsible for the fact that a gas bubble in the intestinal tract produces very much the same appearance on the rœntgen film as a defect in a superimposed or underlying part of the patient's skeleton. Fig. 20 shows such a case, in which a number of apparent defects in the bone are due to superimposed "negative shadows" of gas bubbles while others are in fact due to metastatic cancer.

Another group of pitfalls which deserve separate consideration are those which might be termed "failure to appreciate the inadequacy of a single view or a single direction of projection". Examples of this are the assumption that what appears to be a heart-vessel shadow is really such when it is actually made up of two parts, a normal heart-vessel shadow and an abscess, cyst or tumor, in a different plane so far as its antero-posterior relations are concerned, superimposed upon the same area of the film or overlapping same in the single angle of projection (Figs. 5 and 6). On account of the frequency of this circumstance, it is hardly ever safe to rely upon a single rœntgenogram or a single angle of projection. In terms of human welfare, mistakes are serious and expensive. The price of an extra rœntgenogram would seem to be little by comparison. Very rarely can we justify limiting our examination to one direction of projection. The fluoroscope is of tremendous help in this matter because we hardly ever fluoroscope a patient without obtaining numberless angles of projection.

In this connection I might describe for you what I consider to be an ideal type of examination of the thorax. In my opinion the fluoroscope should be used first and there should be no routine in the matter of rœntgenograms. One case deserves only a single ventral projection, the fluoroscope having satisfied all other requirements; the next case may deserve special treatment with right and left oblique angles of projection, a true lateral, perhaps, a Potter-Bucky diaphragm ventral projection and a dorsal or ventral projection without the Potter-Bucky diaphragm. Sometimes stereo-

scopic studies are indicated. At other times the stereoscopic method is a waste of money and oblique or lateral films or both are essential.

Efforts to determine the size of the heart by means of X-ray studies are subject to a special group of pitfalls. For example, it has become customary to think of a six foot or seven foot ventral projection as free from distortion and magnification. You gentlemen have helped to promulgate erroneous beliefs by sending out, in your "official statement of standards", a stipulation concerning the use of six foot target-film distance for heart size films. As a matter of fact, there is less distortion and magnification in a "six foot film" than in a "four foot film" but there is still plenty of magnification at the six foot distance (Fig. 7). In the very thinnest individual the six foot target-film distance will still permit as much as three or four per cent. of magnification of any given diameter of heart silhouette and I recently proved to a rœntgenologist who disputed my assertions, that a patient whom he was studying, a man with a very protuberant abdomen, produced a cardiac silhouette on a six foot film which had to be reduced by 11% in order to be accurate. In other words, in this unusually thick individual, of unusual shape, the diameter of the heart in which we were interested was 7½ inches from the film and even though a 72 inch target film distance was made, a distortion of 11% occurred in the dimension we were interested in.

I realize that you gentlemen must set up standards. No doubt the rœntgenograms that are made out in the field for transmittal to the home office are already showing improvement as a result of your setting up of standards. Nevertheless, while we are talking about pitfalls in X-ray diagnosis we must acknowledge the fact that the stipulation of a six foot target-film distance does not obviate the possibility of serious error in determinations of heart size, and a four foot target-film distance with a carefully computed magnification ratio is more valuable to us than a six foot film in which no such careful measurement of the magnification ratio has been made.

The whole matter of determination of the size of the heart by X-ray methods[4, 5, 6, 7, 8, 9, 10, 11, 12] is still open to marked improve-

ment. Dr. Scholz' associate, Dr. Nichols[10], has been following out some suggestions I made a few years ago and has developed some very ingenious methods of overcoming the difficulties in this type of work. He reported his early work at your Annual Meeting four years ago. I am looking forward to a finished communication from him which will establish definite methods of a scientific nature for the measurement of heart size. In the same issue of your "Proceedings", Dr. Clark[7] reported fundamental work along these lines, in which the correlation between Body Surface Area and Heart Size was emphasized.

Particularly when we are limited to the ventral angle of projection (so-called straight postero-anterior film), we must be on the lookout for a pitfall which depends for its existence upon the presence of unusually heavy pleuro-pericardial ligaments at the cardio-hepatic angle on the right side and at the apex of the heart on the left side (Fig. 8). The presence of unusually heavy ligaments in these regions is not at all rare[13] and serious errors of interpretation are not infrequently made from this circumstance.

Let us now consider a group of pulmonary conditions which may easily be mistaken for each other. You will see that we have quite a formidable list. Passive congestion of the lung vessels; diffuse bronchopneumonia; a particularly confusing stage of pneumonoconiosis; an unusually diffuse type of bronchiectasis; a certain rather special stage in the development of multiple pulmonary metastases from a malignant tumor. I do not mean to insinuate that X-ray methods are incapable of proving of value in the differentiation between the above conditions. It must be recognized, however, that passive congestion of the lung vessels can simulate inflammatory congestion such as is sometimes found in bronchopneumonia, and a certain phase of pneumonoconiosis may give exactly similar abnormal densities and an exactly similar pattern to certain stages or phases of metastatic neoplasm.

In connection with my mention of pneumonoconiosis it should be pointed out that there are serious pitfalls in the way of him who tries to draw a sharp line of distinction between the earliest tuberculous complication and the case in which no complication

of tuberculosis has appeared, to alter the X-ray appearance of pneumonoconiosis.

After many years, there is a tendency for the abnormal density of pneumonoconiosis to become gathered together in very large masses of fibrotic tissue and in this stage it may be difficult for the rœntgenologist who has not experienced this finding, to differentiate such from neoplastic disease (Fig. 9). Another pitfall in the matter of interpretation of cases of pneumonoconiosis lies in the fact that there is little or no correlation between the severity of the patient's symptoms and the severity of the changes demonstrated by the X-ray. For example, a severe dust exposure of lethal degree, in which the exposure was limited to a rather short duration, six weeks for example, may exhibit no demonstrable change in the X-ray appearance at the end of the lethal exposure to dust, and may exhibit relatively mild although very diffuse changes when the patient has become clinically alarming; on the other hand, a case in which the exposure to the dust was prolonged over a very long period of time and in which the symptoms are relatively benign, may exhibit very, very marked changes in the X-ray appearance. (See Fig. 9.)

Every once in a while the rœntgenologist sees a wide scattering of small ovoid or round calcifications of smooth contours throughout the lung fields and there is a tendency for him to call this "healed miliary tuberculosis" (Fig. 10). Characteristically these patients with the small calcific spots scattered around in the lungs are healthy and it is unusual to obtain an autopsy of such a case. When, as sometimes happens, we do obtain an autopsy on such a case, we invariably find that we have not been dealing with healed miliary tuberculosis. The great majority of these peculiar multiple opacities in the lungs are "osteochondromata", benign tumors of osseous and cartilaginous nature. There are indications that these osteochondromata are congenital and hereditary. They could well be classed as multiple anomalies of the lung.

Thus far we have not by any means exhausted the pitfalls arising from superposition of various unidentified objects upon normal parts. For example, I have embarrassing memories of a

child in whom I mistook the shadow of the lobe of the ear for a foreign body in the nasopharynx. The foreign body which this child was supposed to have "swallowed" was of such a size and description that the shadow of the lobe of the ear fit the story of the mother quite well. Until I fluoroscoped the child I did not discover the true nature of the observed shadow. Numerous examples of braids of hair being misinterpreted, have come to my attention (Fig. 11). Misinterpretations of such shadows may be funny but may also be serious (Fig. 12).

Another group of pitfalls arise in connection with the irregular ossification of laryngeal cartilages. This ossification has no pathologic significance but may introduce grave difficulties in the matter of interpretation of rœntgenograms in cases of suspected foreign body (Fig. 13). In the bibliography at the end of this article I have listed a paper which I wrote on this subject, for those of you who are especially interested[15].

Congenital anomalies and developmental defects are a frequent source of error in the interpretation of rœntgenograms of all parts of the body. Developmental defects may appear in the cranium and be mistaken for foci of bone destruction or metastatic tumor (Fig. 14). Some of the developmental anomalies of the spine and rib cage are easily misinterpreted. Certain of the articulating processes of the lumbar spine are not infrequently crossed by developmental fissures[16] which are readily mistaken for fractures (Fig. 15).

In all of these anomalies the chief danger is that a developmental condition may be mistaken for an acquired lesion of pathologic nature. To avoid error we must first know the normal, second, know the limits of normal variation, third, know the developmental anomalies which are apt to be met with and finally, be familiar with the gross pathology that is to be met with in the region under scrutiny.

We have already touched upon some of the difficulties of interpretation of rœntgenograms of the lungs. One special type of difficulty arises when tuberculosis affects chiefly or exclusively a lower lobe (Fig. 16). I have had numerous instances of this and

it is sometimes impossible to find a basis for even suspecting the real nature of the tuberculous lesion. At other times the type of cavitation is characteristic and even though the location is unusual, the true nature of the lesion is recognized. An opposite type of pitfall occurs when a non-tuberculous bronchial type of pneumonia establishes itself in that portion of the upper lobe which is so frequently the site of a primary lung tissue involvement from tuberculosis (Fig. 17). In a recent case of this type the clinicians and rœntgenologists alike were misled until a complete and rapid disappearance of the abnormal densities proved the process to be non-tuberculous (Fig. 17).

In connection with our discussion of the size and shape of the heart and its rœntgen silhouette, we touched upon such pitfalls as occur when neighboring tumors or cysts or abscesses or fluid collections are superimposed upon the cardiac silhouette (Figs. 5 and 6). We might also discuss for a moment the difficulties that arise in the differentiation between an aneurysm and a mediastinal tumor (Fig. 18). In my own experience there has been some difficulty in interpretation in at least a quarter of the cases of mediastinal tumor and aneurysm. Characteristic types of erosion of vertebral bodies enable us to diagnose aneurysm with certainty. Relationship to trachea, esophagus and other structures may prove very helpful. However, there are certain cases in which the evidence is completely misleading. For example, expansile pulsations may make us feel that we are dealing with aneurysm whereas it may be due to encompassment of the aorta by a group of neoplastic masses. Conversely, many aneurysms give us no suggestion of expansile pulsation. As a matter of fact, it has been my experience that the presence or absence of expansile pulsation is of no diagnostic value in differentiating between aneurysm and mediastinal tumor. One might as well flip a coin as rely upon that finding. In doubtful cases the best method of determining the true nature of the observed mass is to administer two or three X-ray treatments. Three hundred or four hundred rœntgens administered over an aneurysm will do no harm and that amount administered over a mediastinal tumor will cause regression if the

tumor is of the ordinary type which is to be expected in this region (Fig. 18). (The differentiation is not complete since dermoid cysts and ganglioneuromata and certain other conditions are highly resistant or fail entirely to regress under X-ray therapy. However, the ganglioneuromas are usually recognized from their position and relationship to the spinal column and by the presence of measurable alteration of certain spinal structures, and dermoid cysts are also apt to be recognized on account of special features.)

The usefulness of this method of "X-ray therapy for diagnostic purposes" is well exemplified in a recent case (Fig. 19) with the following history. A tumor in the right middle lobe region had been under observation for a matter of several years and was said to be quite stationary so far as change of size was concerned. The absence of any observable progression had led to the assumption that the tumor was benign and radiation resistant. Our decision to administer X-ray treatments was arrived at because the patient complained of a generalized itching of the skin. This always suggests Hodgkin's disease[14] and to the surprise of the clinicians who had followed the case for a long time, three small X-ray treatments of 100 r each resulted in a remarkable regression of the mass in the right lung space (Fig. 19). Because only Hodgkin's disease produces a tumor which regresses under X-ray therapy of small intensity, *after remaining apparently stationary for a matter of years,* and because of the characteristic itching of the skin, a diagnosis of Hodgkin's disease was then made. This was subsequently verified by aspiration biopsy.

In conclusion I wish to thank you for your kind attention. We have by no means exhausted the possibilities in this sphere of X-ray diagnostic pitfalls but perhaps we have exhausted my ability to make the subject interesting. Perhaps you have some questions you would like to ask me.

Dr. Steuart—"Dr. Chamberlain, I would like to ask you to tell us something about the physiologic changes which take place with age as shown in X-ray films of the heart.

DR. CHAMBERLAIN—Dr. Steuart's question brings to my mind a rather important factor which is quite generally overlooked in the matter of interpretation of rœntgenograms of the lungs and heart. I refer to the changes which occur in the size of the heart due to changes in the pressure within the thorax (see Fig. 21).

Let us imagine ourselves in the fluoroscopic room, grouped around the screen, with an average subject, for example a healthy adult male, behind the fluoroscopic screen. We note the average normal size and shape of his heart-vessel shadow. Normal pulsations are seen and a certain amount of change of heart size occurs between systole and diastole, as is to be expected. If we make measurements we probably find that the maximum difference between diastolic and systolic phases amounts to hardly more than 5 or 6 mm. for any given dimension of the heart-vessel shadow.

Let us now ask our subject to close his glottis and exert expiratory effort against his closed throat. Almost at once we see a remarkable diminution in the volume of his heart. In a subject of athletic type, who understands how to carry his breathing experiment to its possible limit, the volume of the heart may be reduced to one-half of its normal average volume. At the same time the pulmonary vessels become drained of their blood content and may become quite invisible. If we now command the subject to breathe naturally we note a quick return of the heart and pulmonary vessels to their normal appearances. Let us now tell our subject to take in a deep breath and hold it. When thus instructed, the average subject takes in a deep breath and closes his glottis and then allows his inspiratory muscles to relax so that the natural tonus of his expiratory muscles exerts pressure upon his thoracic viscera of a sufficient degree to repeat, at least in large part, the above visualized diminution in the size of the heart and pulmonary vessels. This point is of great importance to you gentlemen because a great many of the chest films which are sent to you from distant branch offices, are made under these circumstances and undoubtedly show the heart-vessel shadow much smaller than would be visualized with a more careful technic.

Let us now ask our subject to exert inspiratory effort against a closed glottis while we observe him under the fluoroscope. He can best do this by exhaling rather deeply before he begins the inspiratory effort. We now see a most remarkable increase in the size of his heart and in the size and density of the mediastinal and pulmonary blood vessels. The appearance of the lung fields is that of a severe degree of passive congestion due to a cardiac lesion. The volume of the heart may appear to become as much as twice the normal average volume. This very striking demonstration is of less practical value than the one we studied a moment ago, because it is hardly likely that any such artificial negative pressure will be present within the thorax of a patient during the making of clinical rœntgenograms. Returning now to Dr. Steuart's question regarding physiologic changes with advancing years, changes due to athleticism, changes due to inactivity or changes due to sex, etc., we must admit that much work is to be done before we fully understand all of these factors. However, some very sound work has been done upon these questions and in my bibliography I am referring you to the work of Hodges and Eyster[4, 5, 6, 8]. The figures given by Hodges and Eyster cannot be accepted as final but I believe we can subscribe to their method. They called in a group of life insurance statisticians and obtained significant analyses of their measurements of heart size. By methods which you are familiar with, these statisticians determined the fact that the age factor is of relatively little importance so far as the evaluation of heart size is concerned. For example, the difference between the predicted area of the cardiac silhouette at age 20 and again at age 50 would be only one square centimeter, significant body measurements such as weight and height remaining the same. As a matter of fact, some of us are of the opinion that if we exclude from the group of supposedly normal individuals upon whom the normal criteria are based, cases with minor degrees of hypertension, we might find that there is actually no age factor in the prediction of the volume of the heart. The question has not been settled, but you can see that the factor of age is very small, in any event.

Dr. Armstrong—Can you tell us more about the aorta as well as the heart? Is it possible to say that there are changes in the aorta?

Dr. Chamberlain—We must admit, at the outset, that our ability to visualize the aorta is limited. Visualization of the aorta is not nearly so satisfactory as is visualization of the heart. For an understanding of the reasons, let us remind ourselves that the abdominal aorta is scarcely ever visualized. Stated in another way, we can say that those organs are beautifully visualized which are thrown into relief by a contrasting density such as that of aerated lung or some radiolucent material such as fat. Earlier this afternoon we called attention to the fact that when a tumor or abscess or other abnormal opacity lies in close contact with some part of the heart, we are no longer able to get that part of the heart silhouetted and measurements of heart size become impossible. In the same way, it is very easy to be mistaken in our measurements of the size of the aorta.

At the transverse portion of the aorta we are able to help ourselves through the circumstance that the esophagus contacts the right side of the aortic arch while the left side is practically always silhouetted by aerated lung. By feeding the patient opaque material and turning him into a proper angle, we are usually able to get a very exact measurement of the diameter of the transverse aorta. However, the ascending limb of the aorta is very frequently not reliably visualized and it is in this region that some very foolish statements have been handed about. I am sure you all know what I refer to for you must have received more than one erroneous diagnosis of "aortitis" based upon a ventral projection of the thorax. This is quite ridiculous. It is not possible to make a diagnosis of aortitis or "no aortitis" from the ventral projection of the thorax.

Dr. Bradshaw—We are seeing an increasing number of films of men 45 and over in the oblique position with "hypertrophic arthritis" of the dorsal vertebræ just behind the heart. I would

like to know if you see many of those and have you reached any idea of the significance of that finding?

Dr. Chamberlain—I am very glad that Dr. Bradshaw asked this question. The condition which he refers to as "hypertrophic arthritis" is still referred to by that name quite universally. Personally I adopted an entirely different name more than ten years ago and I believe I will be able to justify this change of name to your entire satisfaction.

This condition, for which I prefer the name devised by Kienböck of Vienna, "Trophostatic Osteoarthrosis", presents an interesting and uniformly observed pathology, whether we find it in the 5,000 years old mummies of Egypt or in our own bodies (Fig. 22). Briefly the pathology consists of 1, the presence of small areas or foci of apparently sterile necrosis in the bone, near (usually very near) the articular cartilage, 2, a large or small degree of molding (change of shape) of the bone due to softening plus pressure from weight bearing or other use and 3, the presence of small or large (sometimes very large) "osteophytes" or "hypertrophic fringes" at the margins of the joint surfaces.

Doubtless you have all observed severe degrees of this condition in the absence of symptoms. This observation led me to make an interesting study some years ago, under the following circumstances.

An old lady of eighty years came under my observation. Among other peculiarities she had a habit of proudly telling everyone with whom she came in contact that she "had never done a lick of work in her whole life". Noticing that she exhibited the skeletal appearance of a very young person, with practically none of the usual demineralization of old age, and with not even a trace of the "osteophytes" which you and I undoubtedly harbor at our joint margins, I made particular inquiries and found that she had indeed lived a life of unusual physical inactivity. She had not even indulged in sports, had preferred to sit out the dances, and had always had a body servant, so that she had never even learned to "put up her own hair".

Having also noticed a remarkable absence of symptoms in subjects with rather marked "osteophytes", I decided to investigate particularly the relationship between the degree of "trophostatic osteoarthrosis" and the vocation and "activity history" of the individual. I therefore hunted up a group of "heavy-lifting" stevedores, the "weak mind and strong back" kind, and found, in men who boasted that they had never had such a thing as a backache, remarkable degrees of this condition.

Further study has convinced me that while there is no correlation whatever between the degree of "trophostatic osteoarthrosis" and the subject's symptomatology, there is indeed a very good correlation between the degree of development of said condition and the subject's "work history" or "activity history". It is among the "heavy lifters" that this condition achieves its greatest development.

You can now understand why I favor Doctor Kienböck's name for this condition, for it signifies the presence of *trophic* factors; factors having to do with *posture, pressure* or *static strain;* an involvement of the bone of *non-inflammatory type* (an osteosis rather than an osteitis); and a *non-inflammatory* affection of the joint (an arthrosis rather than an arthritis).

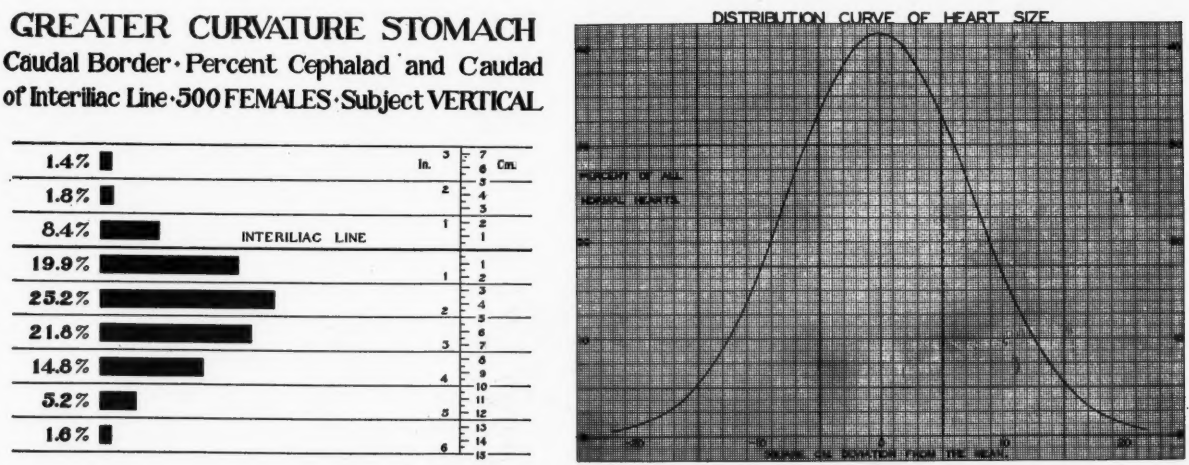


FIGURE 1. Typical "Distribution curves"—obtained by plotting numbers of cases or percentages against measurements. The "curve" on the left was obtained by plotting measurements of the position of the greater curvature of the stomach with respect to the level of the iliac crests, with the subjects in the erect position. The curve on the right is the theoretically perfect distribution curve of the area of the cardiac silhouette as measured by the orthodiagram, obtained by plotting "percentages of all normal hearts" against the number of square centimeters by which those percentages deviate from the mean.

FIGURE 2. Artefacts produced by discharge of static electricity upon the surface of the X-ray film before it has been processed. The most frequent cause of this artefact is carelessness in removing the black paper covering which is routinely supplied by the manufacturer. It is most apt to occur when the relative humidity is very low as in the presence of steam heat. Many other types of artefact are described in the text.

FIGURE 3. Anything which displaces and replaces the opaque medium which has been introduced into a hollow viscus for diagnostic purposes may be said to produce a "filling defect". In this remarkable illustration filling defects are exhibited which are due to three different causes; 1, collections of gas (readily recognized); 2, collections of fecal matter (indistinguishable from pedunculated tumors); 3, pedunculated tumors which were verified subsequently at operation. Operative findings proved that only the filling defects in the sigmoid portion of the colon are due, in this present case, to tumor. All of the other filling defects are due to fecal matter or gas.

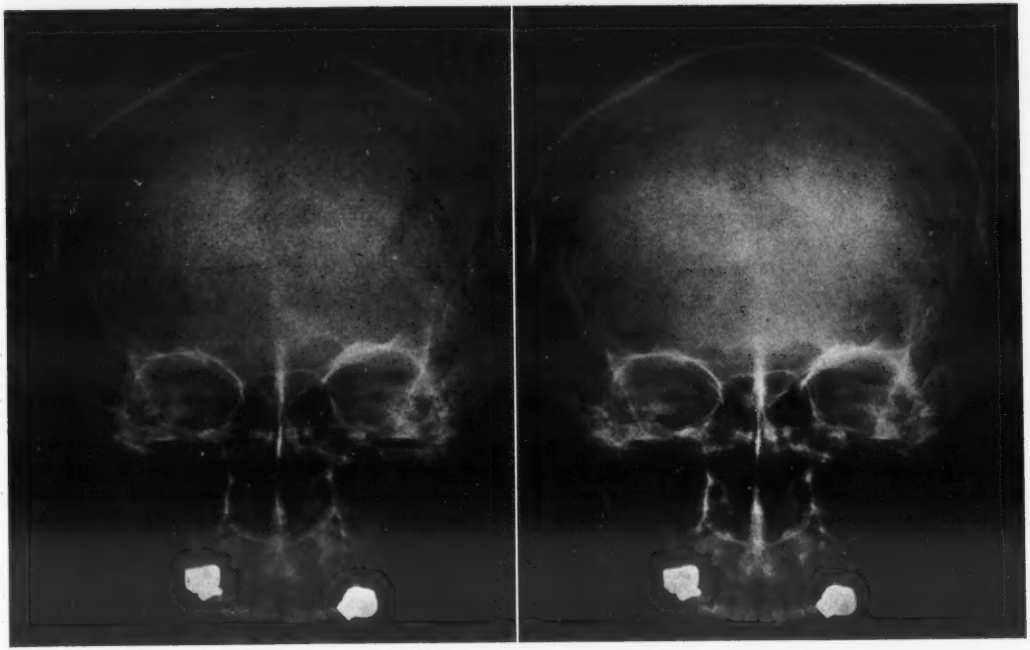


FIGURE 4. Fracture of the cranial bones simulated by the presence of a gaping wound in the scalp. The film on the left is an anteroposterior study made in the presence of a gaping wound in the left parieto-occipital region. The film on the right was made a few moments later, after the gaping scalp wound had been sutured. The reason for the occurrence of such a shadow in the absence of defect in the bone is the blackening of the film under the gaping wound where X-rays that would normally have been absorbed by the soft tissues were permitted to reach the film.

where X-rays that would normally have been absorbed by the soft tissues were permitted to reach the film.

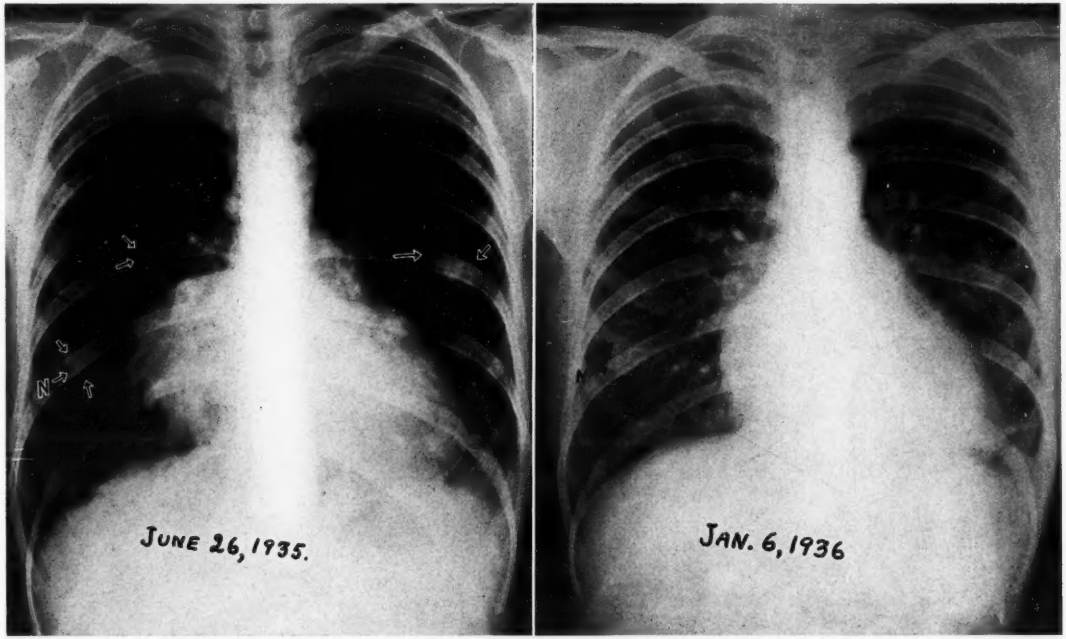


FIGURE 5. Metastatic nodules in the lungs, before and after rœntgen therapy, and confusing shadow of prominent nipple. At the first examination the shadow of the right nipple "N" was thought to be due to another tumor nodule. When it remained unchanged in appearance after all of the other "nodules" had regressed, its true nature was recognized. (The film of June 26, 1935 also illustrates how a superimposed mediastinal tumor may merge with the heart to produce a shadow that suggests cardiac enlargement. See Fig. 6.)

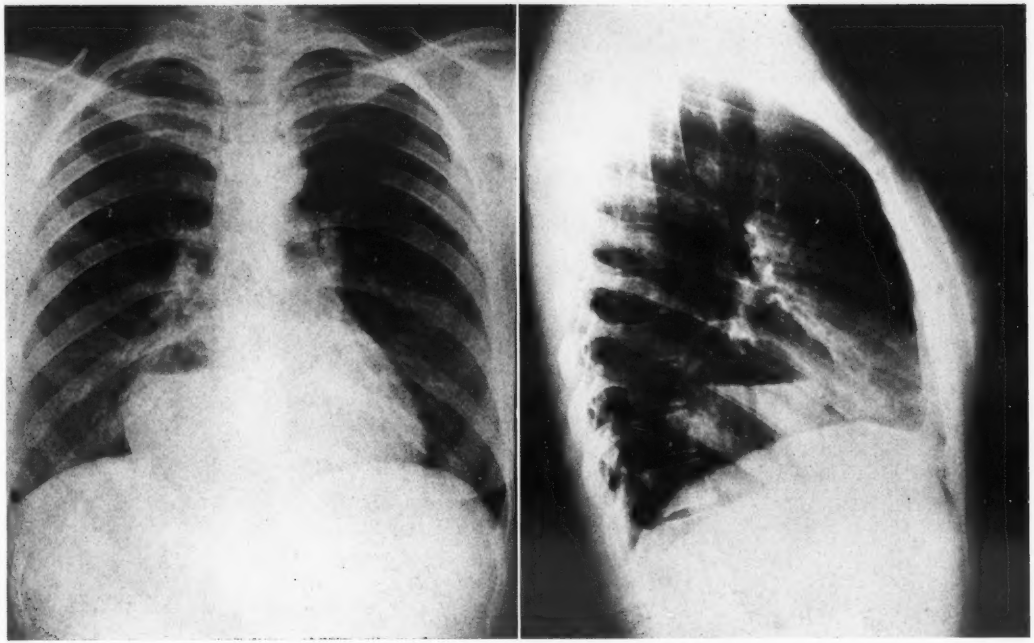


FIGURE 6. Enlargement of the heart would have been simulated in the anteroposterior view in this case, had the infected cyst not contained a bubble of air. The lateral projection enables us to distinguish the infected cyst from the adjacent heart, but even here the demarcation would be somewhat incomplete were it not for the chance presence of air within the cystic cavity. Pitfalls of this type include simulation of aneurysms by enlarged hilar glands, etc.

glands, etc.

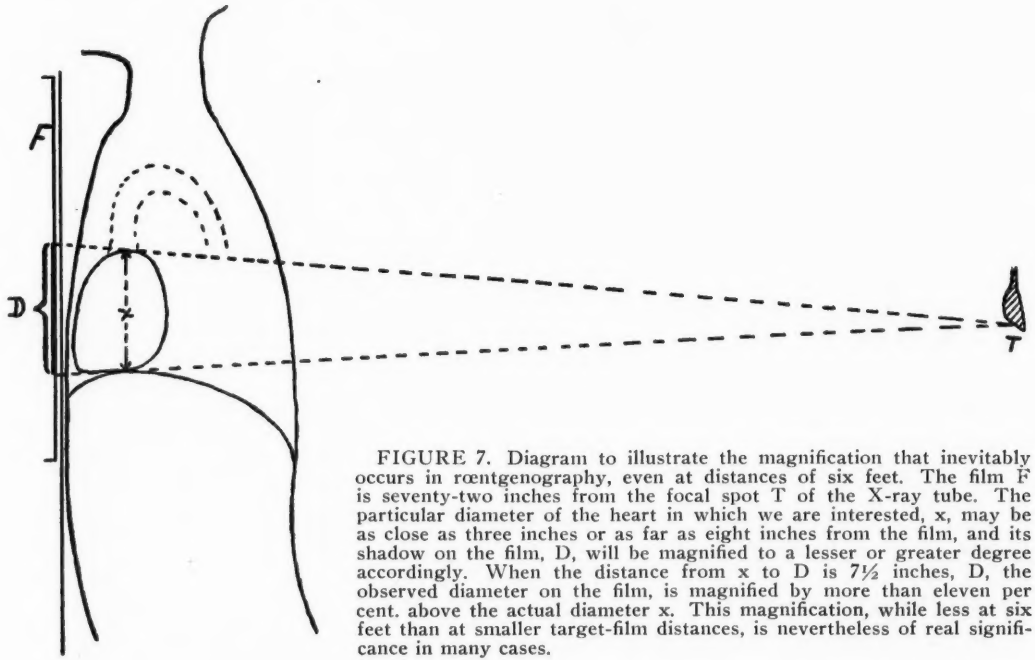


FIGURE 7. Diagram to illustrate the magnification that inevitably occurs in rœntgenography, even at distances of six feet. The film F is seventy-two inches from the focal spot T of the X-ray tube. The particular diameter of the heart in which we are interested, x, may be as close as three inches or as far as eight inches from the film, and its shadow on the film, D, will be magnified to a lesser or greater degree accordingly. When the distance from x to D is 7½ inches, D, the observed diameter on the film, is magnified by more than eleven per cent. above the actual diameter x. This magnification, while less at six feet than at smaller target-film distances, is nevertheless of real significance in many cases.

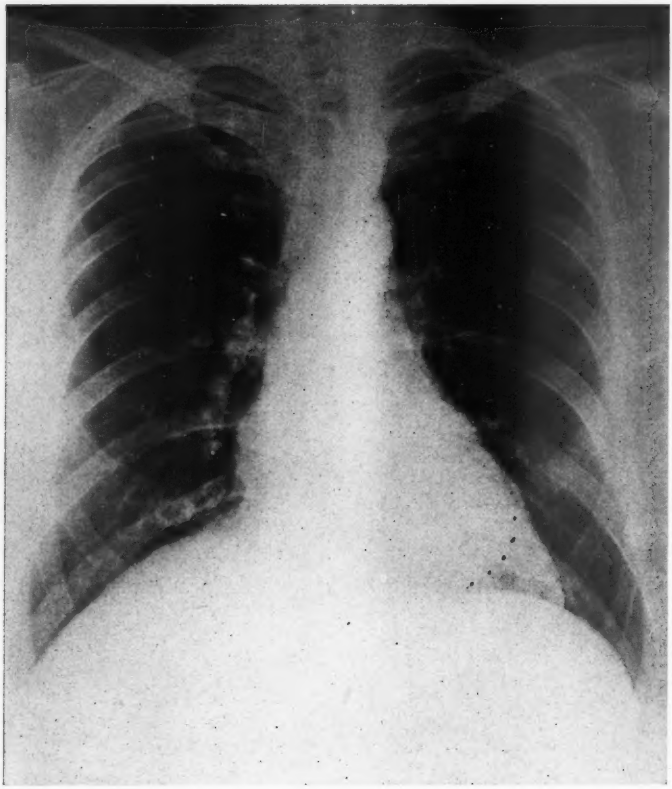


FIGURE 8. Confusion of cardiac silhouette with prominent pleuropericardial ligament. This anatomical variation is fairly frequent and may not be correctly interpreted, especially if the rœntgen examination does not include a fluroscopic study. A rœntgenogram of such density as to be ideal for the study of the lungs is particularly apt to be misleading when it comes to differentiating between the borders of the cardiac silhouette and such a prominent ligament.

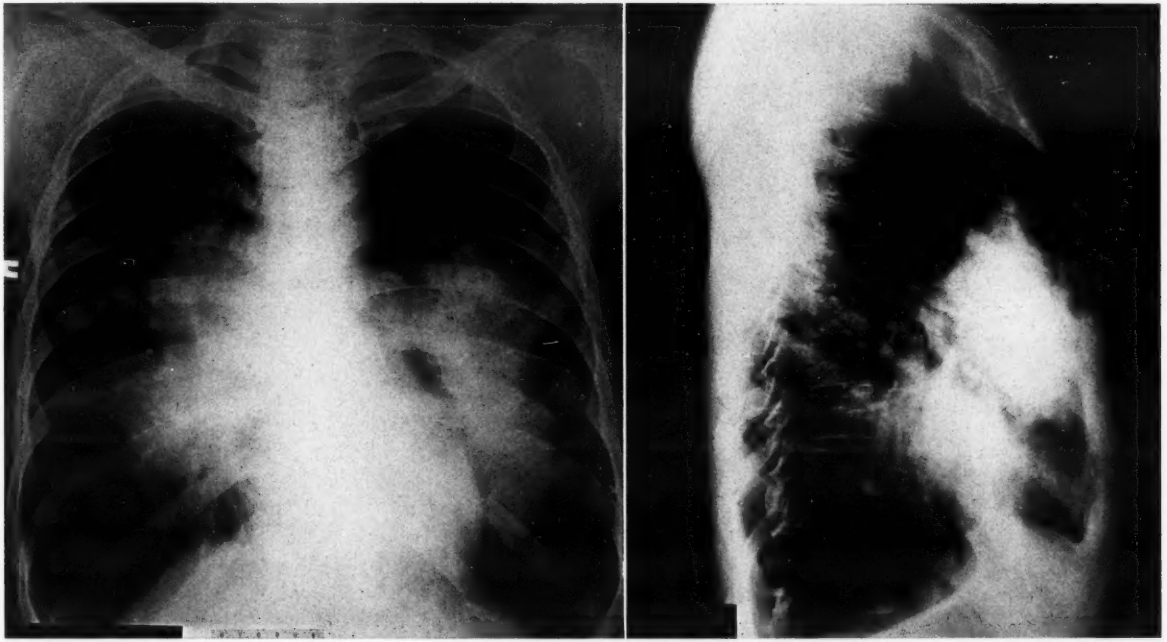


FIGURE 9. Pneumonoconiosis (silicosis) simulating neoplasm. This patient was not very greatly inconvenienced by his disease. His exposure to dust was relatively mild and long continued and occurred many years before the present rœntgenograms were made. The large collections of abnormal density are not due to the inhaled mineral but to the quantities of fibrous tissue which have been laid down as a result of the injury from dust.

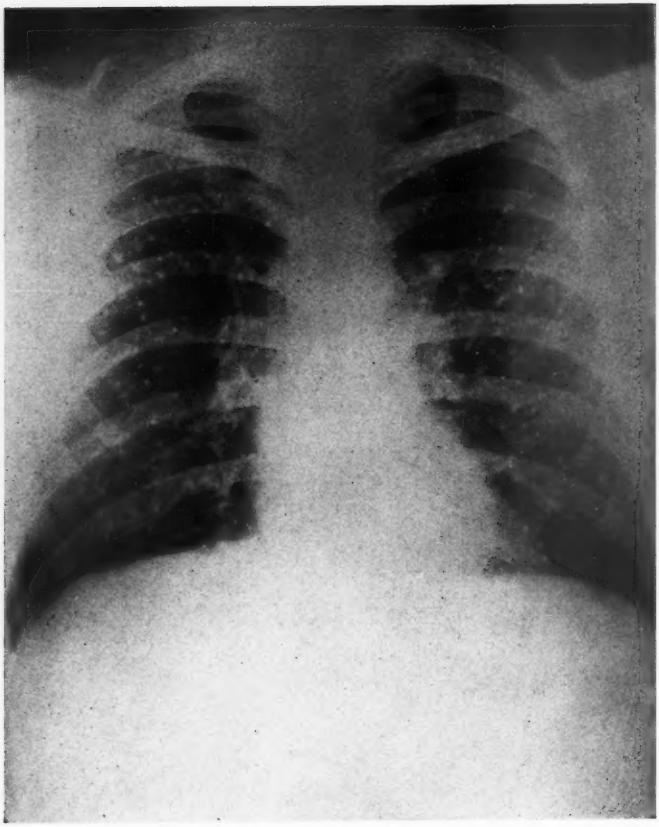


FIGURE 10. Osteochondromatosis. This is often mistaken for "healed miliary tuberculosis". The density of the small, round and ovoid masses is due to true bone and not to "calcification". The condition is without clinical significance and can be classified as an anomaly.

FIGURE 11. Abnormal opacity in skull or brain simulated by braided hair. Immediately after this present film was obtained, the hair braid was loosened and the confusing shadow of the hair braid was completely absent in subsequent rœntgenograms. The reader may have difficulty in understanding how an organic material such as hair can produce such distinct shadows. The explanation lies in the fact that the hair braid was surrounded by air. The same braid of hair if submerged in fluid or tissue would fail to produce a distinguishable shadow.

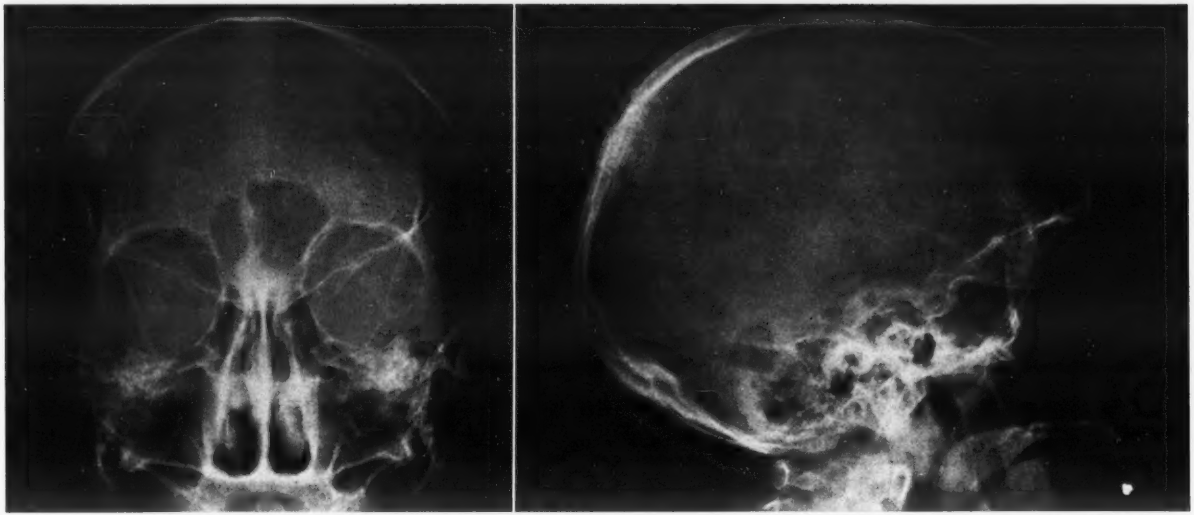


FIGURE 12. The bone changes overlying a meningioma are simulated in this case by iodoform gauze packed in a gaping skull wound. The position of the wound was such that an appearance of intracranial localization was obtained in both lateral and anteroposterior views.

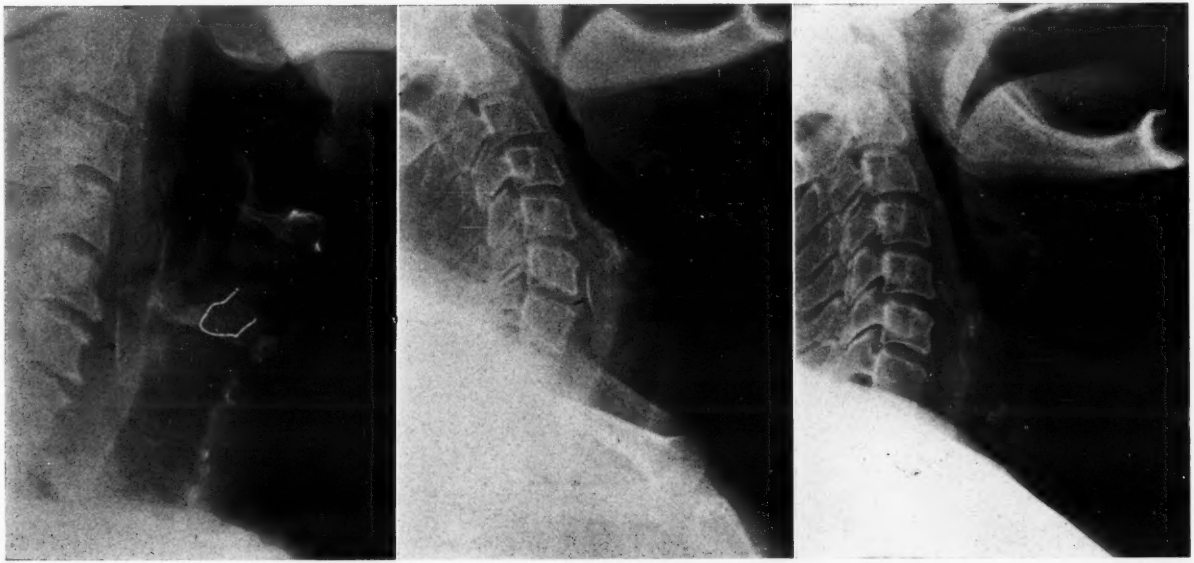


FIGURE 13. Ossification of laryngeal cartilages differentiated from foreign body in the food passage. The view on the left is of a normal larynx in which the posterior surface of the lamina of the cricoid cartilage is ossified to a greater degree than other parts of the cricoid. There are times when only this part of the cricoid is ossified, and under such circumstances its position may lead to confusion with opaque foreign body. The center view is of an actual foreign body, a chicken bone, behind the cricoid cartilage. Note the similarity of location and appearance to the ossification in the figure on the left. The view on the right was made after successful removal of the foreign body.

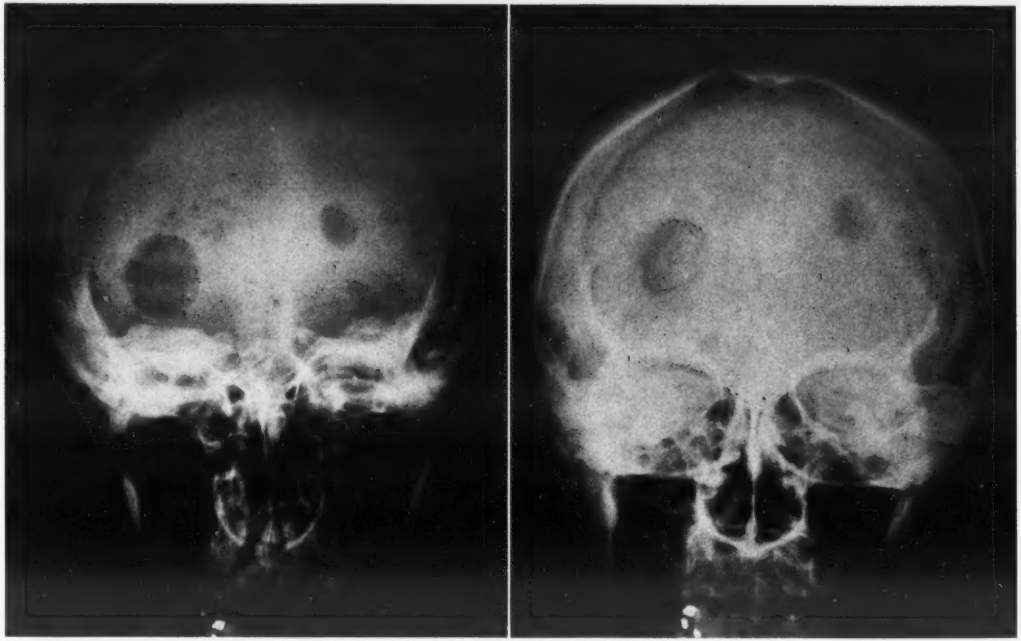


FIGURE 14. A case of metastatic carcinoma of the cranium from a primary breast tumor. The two major defects happened to be at approximately the location which is a common one for congenital developmental defects. The view at the right was made after irradiation. Some of the smaller defects have filled in completely and the larger ones are exhibiting regression. This patient progressed to apparent cure and has had no recurrence up to the present time. It is of interest to know that the disappearance of tumor in this case was a result of irradiation administered to the ovaries rather than locally to the metastatic lesions. See also Fig. 20.

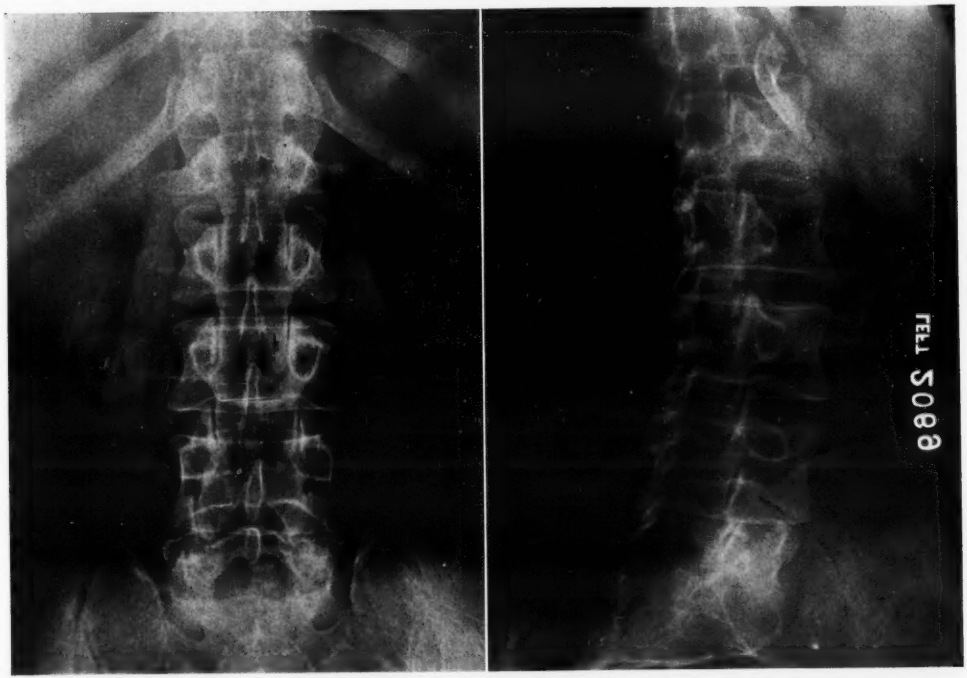


FIGURE 15. Anomalous fissure in the "postzygapophysis" of the second lumbar vertebra, simulating fracture. The second and third lumbar vertebrae are most often affected in this way, and in some instances the appearance is so identical with that of fracture that only the knowledge of the existence of such an anomaly prevents misinterpretation.

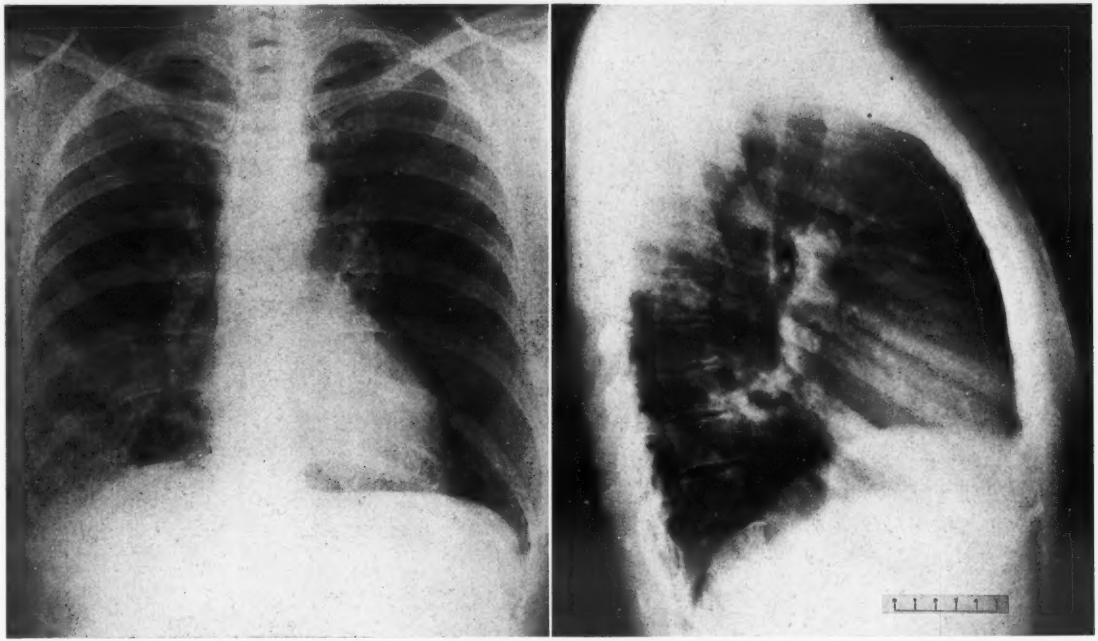


FIGURE 16. Pulmonary tuberculosis localized in the lower lobe of the right lung. In this location it is very difficult to avoid the error of concluding that the lesion is non-tuberculous. In this present case the correct interpretation was made, mostly because of the presence of a fairly characteristic type of cavitation within the affected right lower lobe. The fluid level in the cavity is faintly shown in the anteroposterior view.

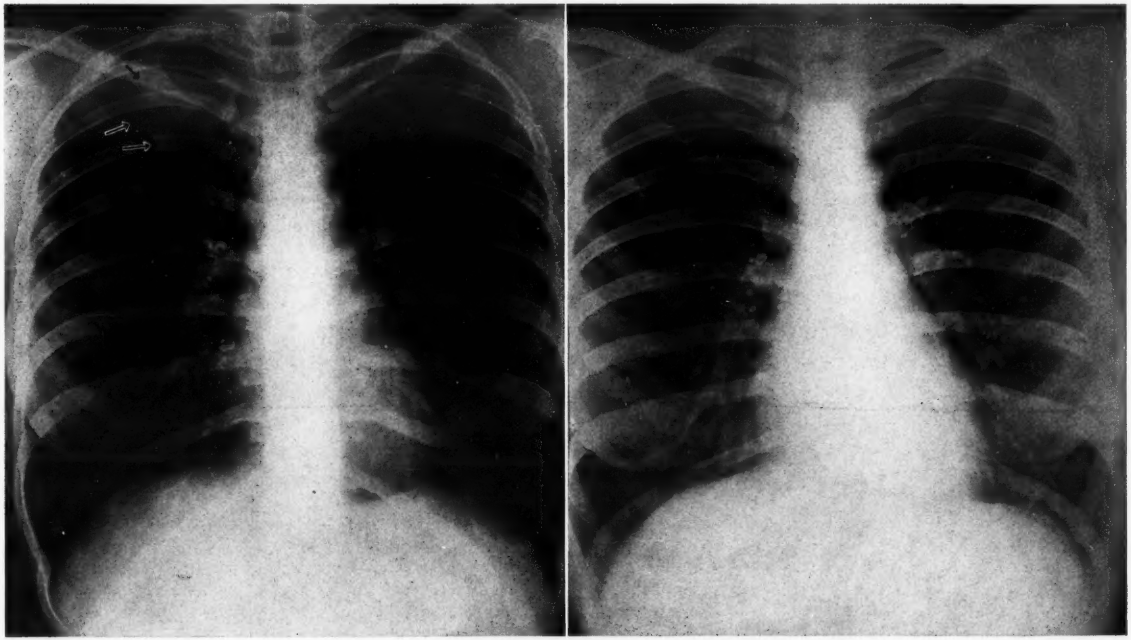
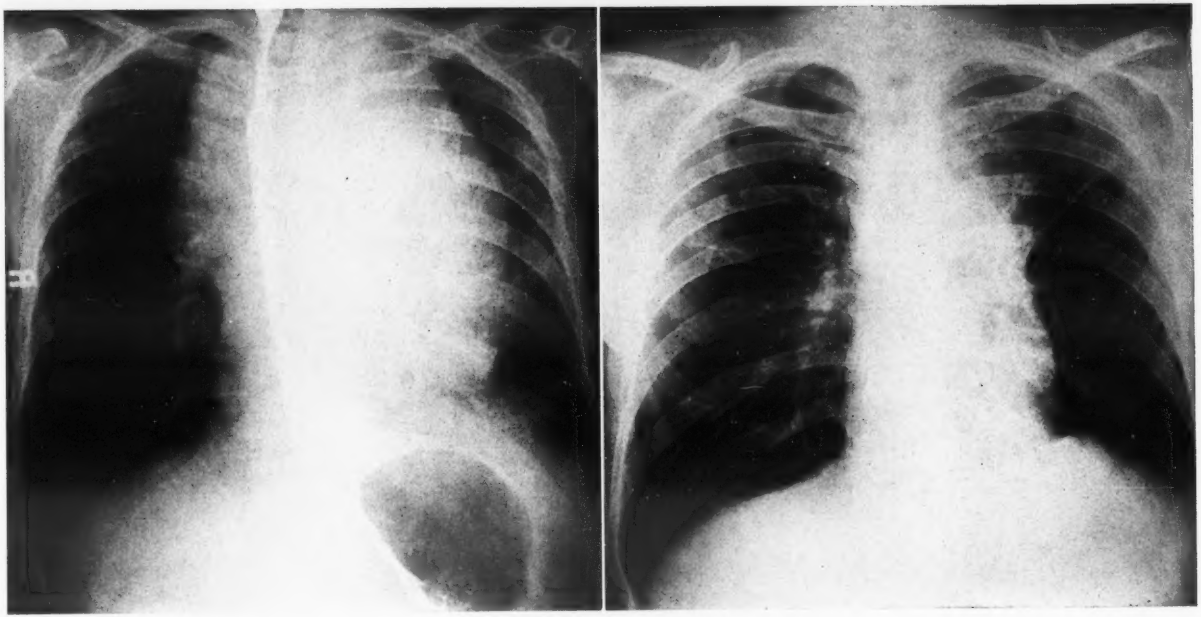


FIGURE 17. Non-tuberculous bronchopneumonia mistaken for pulmonary tuberculosis. In this case the cards were stacked against the rœntgenologist. The floculent opacities in the right upper lobe field are characteristic of an early stage of pulmonary tuberculosis and the presence of calcified scars at the right hilum offered further evidence for a tuberculous etiology. The view on the right was made six weeks later and the complete disappearance of the abnormal density in the right upper lobe field marks this as a case of non-tuberculous bronchopneumonia.



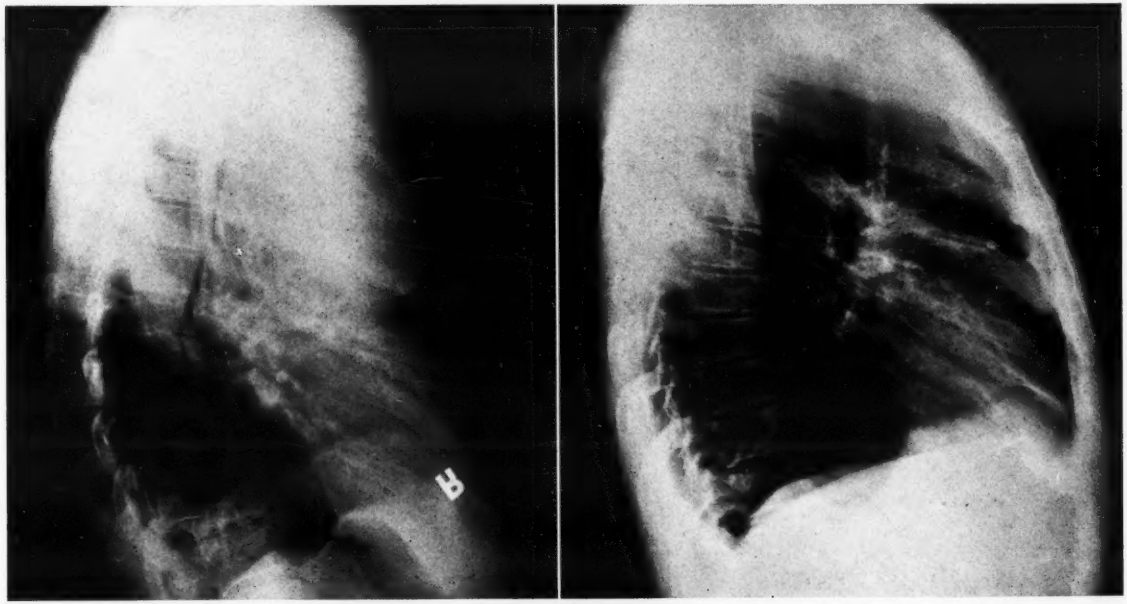
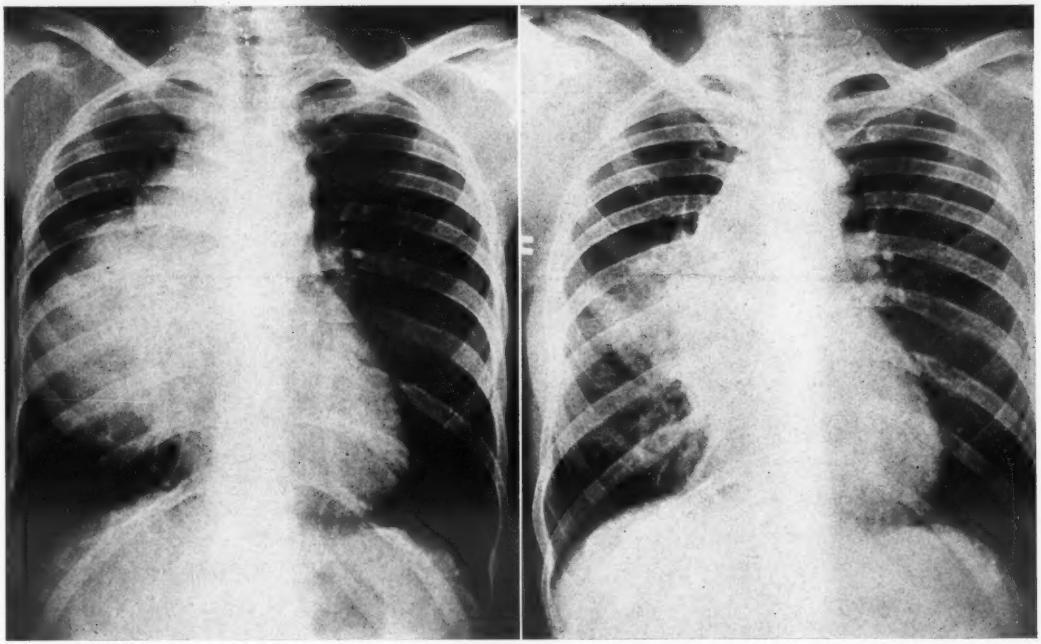


FIGURE 18. Mediastinal tumor mistaken for aortic aneurism. Rœntgenograms, on the left before, on the right after, rœntgen therapy. This patient had been clinically and rœntgenologically diagnosed as aneurism and was sent to the author solely for the purpose of getting a film record of the size of the "aneurism", prior to the surgical production of a therapeutic arterio-venous fistula in the peripheral circulation. On the chance that the condition might be neoplastic, and because moderate irradiation does no harm in aneurism, three small daily doses of 100 r each were administered. The result proved the existence of a highly radio-sensitive tumor. Marked expansile pulsation was noted fluoroscopically in this case, a fact which contributed to the misinterpretation (see text).



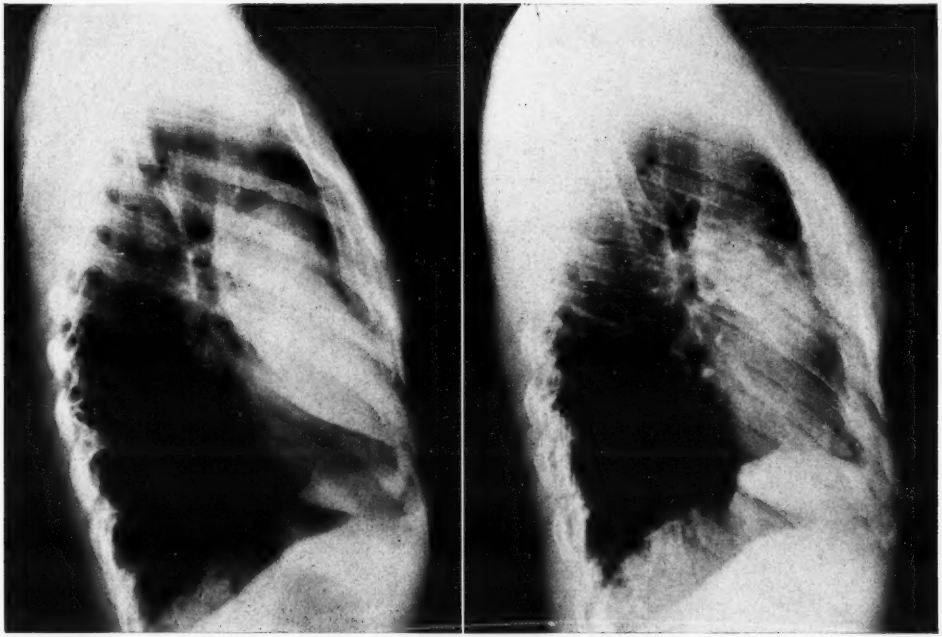


FIGURE 19. Extraordinary case of Hodgkin's disease primary in the lung. Rœntgenograms, on the left before, on the right after, rœntgen therapy. Because this Hodgkin's tumor had remained perfectly stationary for a matter of years, its true nature had been overlooked. Under rœntgen therapy the improvement in the patient's symptoms was as spectacular as the improvement in the X-ray appearance. Moderate irradiation should be used for its diagnostic value in cases of this type because ability to classify such a tumor as "radiation resistant" or "radiation sensitive" will often permit a final diagnosis which would otherwise not be possible.

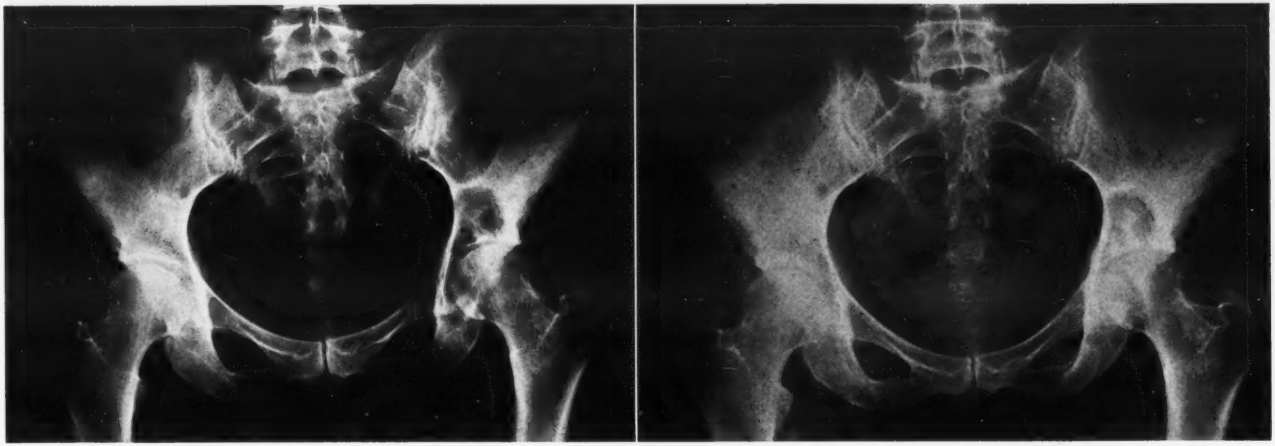


FIGURE 20. Breast cancer metastatic to various parts of the skeleton (same case as Fig. 14). The view on the left is before irradiation. That on the right shows the partial disappearance of the lesions after irradiation. Note the similarity between the X-ray appearance of gas bubbles in the intestinal tract and real defects in the skeleton due to neoplasm.

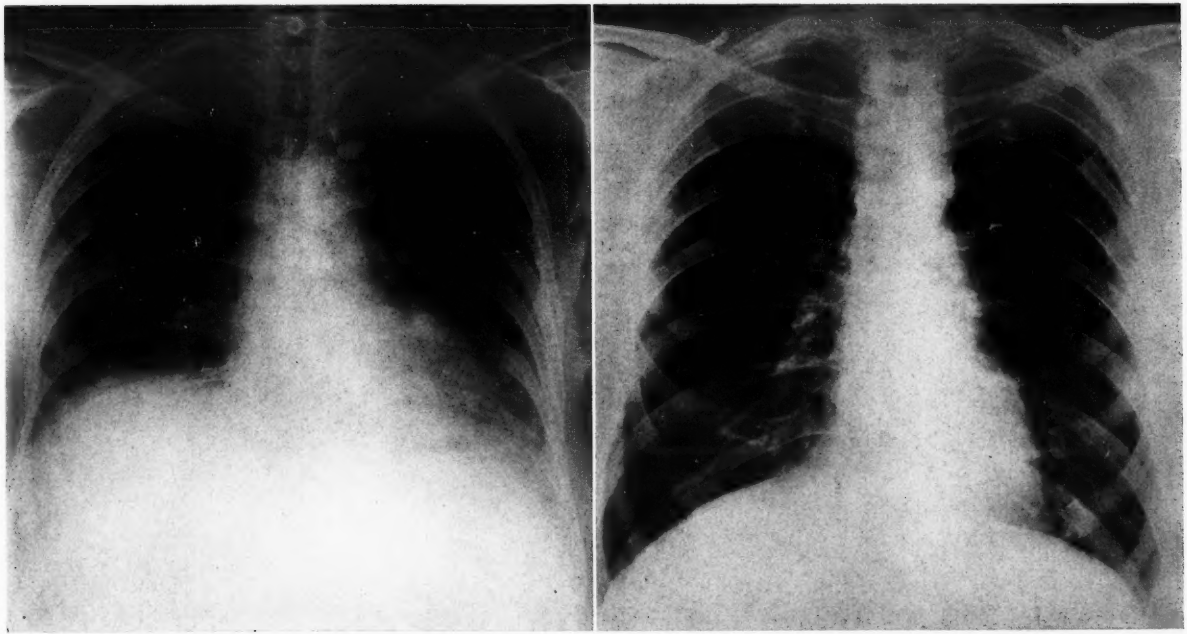


FIGURE 21. "Pulmonary congestion" and "emphysema" produced by studied respiratory effort in a normal subject. The film at the left was made at a fairly complete phase of expiration and with inspiratory effort against the closed glottis. Note the "enlargement" of the heart and lung vessels, and the clouding of the lung fields at the bases. The film at the right was made at a fairly extreme phase of inspiration with expiratory effort against the closed glottis. The heart and pulmonary and mediastinal vessels have become smaller than in their normal average state because blood has been forced out of the blood containing spaces of the thorax by the increased intrathoracic pressure. These remarkable changes can be observed fluoroscopically (see text).

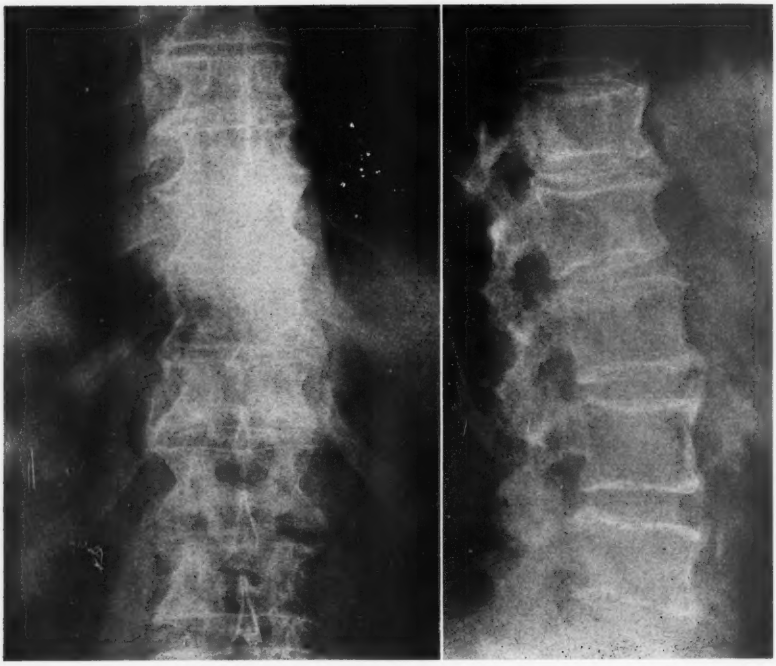


FIGURE 22. Trophostatic Osteoarthrosis (so called Hypertrophic Arthritis). Note the changes of shape of the vertebral bodies indicating the involvement of bone as well as joint margins. The hypertrophic changes (hooks, fringes, spurs) are best characterized as "osteophytes". There is little or no correlation between the degree of change in the X-ray appearance and the presence or absence of symptoms. Many severe involvements of this type are unassociated with symptoms (see text). The term "Hypertrophic Arthritis" is a misnomer because the condition is an osteo-arthrosis rather than an arthritis (joint inflammation). Furthermore, the proliferative form of arthritis, to use the commonly accepted classification, is proliferative in the peri-articular soft tissues rather than in the bone and is commonly associated with bone destruction and demineralization rather than with bone hypertrophy.

BIBLIOGRAPHY

1. Henny, George C.: "Artefacts in Rœntgen Films", Radiology, v. 24, p. 350, (March) 1935.
2. Moody, R. O., Van Nuys, R. G. and Chamberlain, W. Edward: "Position of the Stomach, Liver and Colon", Jour. Amer. Med. Assoc., v. 81, p. 1924, (Dec. 8) 1923.
3. Moody, R. O., Chamberlain, W. Edward and Van Nuys, R. G.: "Visceral Anatomy of Healthy Adults", Amer. Jour. Anatomy, v. 37, p. 273, (May 15) 1926.
4. Hodges, P. C. and Eyster, J. A. E.: "Estimation of Cardiac Area in Man", Amer. Jour. Rœntgenology, v. 12, p. 252, 1924.
5. Hodges, F. J. and Eyster, J. A. E.: "Estimation of Transverse Cardiac Diameter in Man", Arch. Internal Med., v. 37, p. 707, 1926.
6. Eyster, J. A. E.: "Determination of Cardiac Hypertrophy by Rœntgenray Methods", Arch. Internal Med., v. 41, p. 667, 1928. (Also, under same title, Transactions Assoc. Amer. Physicians, v. 43, p. 18, 1928.)
7. Clark, Charles P.: "A Theoretical Study of Blood Pressure and Its Relation to Heart Size, Body Surface Area and Metabolic Rate", Proceedings of the Association of Life Insurance Medical Directors of America, v. 20, p. 238, 1933.
8. Eyster, J. A. E. and Meek, W. J.: "Instantaneous Radiographs of the Human Heart at Determined Points in the Cardiac Cycle", Amer. Jour. Rœntgenol., v. 7, p. 471, (Oct.) 1920.
9. Smith, H. W. and Bloedorn, W. A.: "The Size of the Normal Heart: A Tele-rœntgen Study", U. S. Navy Med. Bull., v. 16, p. 219, 1922.
10. Nichols, C. F.: "Determination of Cardiac Hypertrophy", Proceedings of the Association of Life Insurance Medical Directors of America, 1933.
11. Chamberlain, W. Edward and Dock, W.: "The Study of the Heart Action with the Rœntgen Cinematograph", Radiology, v. 7, p. 185, (Sept.) 1926.
12. Chamberlain, W. Edward and Dock, W.: "Motion of the Heart in Disease of the Mitral Valve", Arch. Internal Med., v. 40, p. 521, (Oct.) 1927.
13. Kautz, F. G. and Pinner, M.: "Extra pericardial Fat Bodies", Amer. Jour. Rœntgenol., v. 36, p. 40, (Jan.) 1936.
14. Chamberlain, W. Edward and Young, B. R.: "Hodgkin's Disease", Jour. Med. Soc. of New Jersey, v. 31, p. 415, (July) 1934.
15. Chamberlain, W. Edward and Young, B. R.: "Ossification (so-called "Calcification") of Normal Laryngeal Cartilages Mistaken for Foreign Body—A Correlation of Rœntgen and Histologic Findings", Amer. Jour. Rœntgenology, v. 33, p. 441, (April) 1935.
16. Rendich, R. A. and Westing, S. W.: "Accessory Articular Process of the Lumbar Vertebrae and Its Differentiation from Fracture", Amer. Jour. Rœntgenology, v. 29, p. 156, (Feb.) 1933.

Dr. Russell—I think everyone will agree that we know a lot more about X-ray diagnosis than we did before this splendid talk. We are very much indebted to Dr. Chamberlain. We are very, very fortunate in having him. Thank you, Dr. Chamberlain.

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Through the courtesy of the National Tuberculosis Association, an interesting film, entitled "Behind the Shadows," was shown at this time.

* * * * * *

On two previous occasions this Association has had the pleasure of listening to the next speaker. For several years he has been carrying on an investigation, under the auspices of the Medical Department of the Metropolitan, to determine the incidence of syphilis in life insurance applicants. Today, in conjunction with his collaborators, Marguerite Le Moine and Margaret G. Stephens, he is prepared to submit the results. I am sure that we are all glad to welcome once again Dr. Charles R. Rein of New York City.

WHAT ARE LIFE INSURANCE COMPANIES DOING ABOUT SYPHILIS?

By Charles Robert Rein, M. D., Marguerite Le Moine and Margaret G. Stephens

New York

Although syphilis is much more prevalent than tuberculosis or diabetes, very little is done by insurance companies to detect this disease among applicants.

In 1932 we presented before this Association a preliminary report[1] on the value of the Kline test for the detection of syphilis in applicants for life insurance. At the 1934 meeting a second report[2] was presented which gave the results of 3,230 tests. At this time we are reporting on a total of 6,900 tests which were performed at the Metropolitan Life Insurance Company from May 20, 1932 to July 31, 1936 (See Table I).

TABLE I

TESTS PERFORMED AT METROPOLITAN LIFE INSURANCE COMPANY 1932–1936

Source of Cases	Number	% of Pos. Tests
Cases of suspected syphilis. Blood collected by Field Examiner or at the Home Office	2,200	13.0
Consecutive cases, examined at Home Office, who had electrocardiographs because of known or suspected heart or circulatory impairment	1,000	2.3
Others	3,700	Not Available
Total	6,900	

It is interesting to note that when the Kline test was done routinely on the 1000 consecutive cases who had electrocardiograms

because of a suspected or known cardiovascular impairment, only 2.3% gave positive reactions; when the Kline test was done, however, on the selected group of 2,200 applicants for insurance, who presented symptoms or gave histories suggestive of syphilis, approximately 13% gave positive reactions.

In order to ascertain what other insurance companies are doing regarding the use of serologic tests for the detection of syphilis in applicants for life insurance, we sent out the following questionnaire.

Do you request a serologic test for cases of suspected syphilis in applicants for life insurance?_____

If so:

1. Which test do you use?_____
2. Is the test performed
   at the Home Office only?_____
   at an outside laboratory only?_____
   at either?_____
3. Do you request the test
   regardless of amount of insurance applied for?_____
   for specified amount of insurance applied for?_____
4. How many serologic tests have you made in a recent months' period?_____
5. How many were positive?_____

If not:

Have you any objection to the use of a serologic test?_____

These questionnaires were sent to 97 insurance companies and 75 replies were received. Although 56 (75%) companies requested serologic tests, few of them did more than 30 tests each during the past year. (See Table II).

It is surprising that more tests are not done, especially since it is known that this disease is widespread and that their mortality probably is high. Some companies depend upon the history to detect an infected individual. Attempts to secure an accurate syphilitic history in connection with an insurance examination are practically useless. The majority of those who know they have been infected will deny it for obvious reasons. Many of these syphilitics will pass a physical examination because the infection

is in the latent stage or because the examiner is not sufficiently trained to diagnose syphilis in its rare and concealed forms. In addition, many latent syphilitics are quite unaware of the disease. In fact, it has been estimated that about 50% of the syphilitics are unaware of the infection. A routine blood test is therefore of the utmost importance in life insurance work for an examiner is apt to be unaware of the presence of a syphilitic infection with the single physical examination, the cursory history, and especially the uncertain venereal history.

TABLE II

ANALYSIS OF THE FIFTY-SIX INSURANCE COMPANIES PERFORMING BLOOD TESTS

	Kline Test Only	Kline or Other	Wasserman and/or Kahn	Not specified or "any"	Total
Test performed at H.O. only	6	–	–	–	6
Test performed at Outside Laboratory only	2	4	26	16	48
Test performed at either	–	–	2	–	2
Requested regardless of amt.	7	4	28	15	54
Restricted by amt. of ins.	1	–	–	1	2
Number of tests in 12 mos. "Very few", "none", "Small number"	–	1	8	5	14
1— 9	–	1	9	–	10
10—29	1	–	3	6	10
30—99	1	1	1	1	4
100 plus	4	–	–	–	4
Not stated	2	1	7	4	14
Total	8	4	28	16	56

Some companies have objected to the routine use of blood tests for various reasons:

1. A few have experienced some difficulty in collecting specimens in the field.

The Kline test is especially applicable for insurance work because sufficient blood for the test is easily obtainable from a finger or ear lobe puncture and easily collected in capillary tubes. In addition, no chemicals need be added to prevent clotting or bac-

terial contamination. The blood can be sent with safety over long distances to a central laboratory for examination and is satisfactory for testing within ten days after collection. These bloods can be collected by the field examiner in a few moments.

2. Other companies state that they have no facilities for performing the test in their own laboratories.

The Kline test can be done in small home office laboratories with a minimum amount of equipment. It has been estimated that each test costs about twenty cents, which includes not only the cost of all materials but also the technician's salary. One hundred or more tests could be completed in less than two hours. In spite of this, 90% of the companies that request blood tests resort to outside laboratories. In fact, some companies merely request the applicants to present a report from a recognized laboratory. It might be a simple matter for a syphilitic applicant to have someone else ask for a blood test in his name.

3. A few companies object to doing blood tests because they do not want the responsibility of the venesection when performed by their examiner or representative.

There are, however, practically no untoward results when the blood is obtained from the puncture of a finger or ear lobe (as for a blood count) and therefore little or no responsibility is encountered by the company.

4. Other companies object to the use of blood tests until the public becomes better educated as to their value.

The public is receiving this much needed information through the many articles on syphilis which have recently appeared in magazines and newspapers, and through radio talks. Considerable progress along these lines has been made by the various public health and social hygiene organizations.

5. No company does a blood test as a routine procedure, but some request a test when the history or other circumstances make it advisable.

Such a procedure is quite unsatisfactory, because in many instances the examiner will find nothing in the history or physical examination suggestive of syphilis. It is a well known fact that

in a large number of cases the positive blood test may be the only evidence of latent syphilis. No examination of applicants for insurance should be considered complete without a blood test for the detection of syphilis. It has been suggested that all companies do blood tests on all applicants for life insurance of $5000 or more.

About 50% of the companies that requested blood tests specified the Wasserman and Kahn. It is probable that they do not request the Kline because it is relatively new. However, during the past year the United States Public Health Service in collaboration with the American Society of Clinical Pathologists have had two serologic conferences in the United States to determine the efficacy of the various serologic tests for the diagnosis of syphilis[3]. A recent report[4] on the evaluation of the first conference clearly demonstrated that the Kline diagnostic test (the very test which we advocate and use for insurance work) was the most specific of all competing tests; that is, with the Kline diagnostic test there was not a single false positive or even a false doubtful reaction. In addition, the Kline exclusion test, which is more sensitive that the former, gave the highest percentage of positive reactions in syphilitic patients when compared with the other first-class tests in this conference.* Therefore, by doing a Kline diagnostic and exclusion test on a blood specimen one is able to obtain the maximum specificity and maximum sensitivity.

Conclusions

It has been estimated that approximately five to ten per cent. of the population of this country are affected with syphilis. The probable incidence of syphilis among applicants for insurance, however, is much lower (two to three per cent.). During 1935 there were about two to two and a half million applicants for ordinary life insurance. Therefore, among this group there were about 50,000 syphilitic individuals. From the analysis of the questionnaires received in this investigation only, about 250 (0.5 per cent.) syphilitics were detected. Insurance companies are accepting approximately 50,000 syphilitic applicants each year. It

*A first-class test for syphilis is one that gives less than 1% false positive reactions.

*From the Medical Division, Metropolitan Life Insurance Company.

is hoped that some day soon *all* insurance companies will do routine blood tests on *all* applicants for insurance.

BIBLIOGRAPHY

(1) Rein, C. R.—The Value of the Kline Precipitation Tests for Syphilis; Proc. A. Life Insur. M. Dir. America, 19:275, 1932.

(2) Rein, C. R. and Le Moine, Marguerite—Value of the Kline Precipitation Test for Detection of syphilis in Applicants for Life Insurance; Proc. A. Life Insurance M. Dir. America, 1934; also Arch. Dermat. & Syph. 30:190 (August) 1934.

(3) Evaluation of Serodiagnostic Tests for Syphilis; Ven. Dis. Inform., Washington, D. C., Dec. 1934, 15:387; also J.A.M.A., Chicago, Dec. 1, 1934, 103:1705.

(4) Rein, C. R.—The Value of the Kline Exclusion Test in the Serodiagnosis of Syphilis. Am. Jr. of Syph., Gon. & Ven. Dis., Vol. 20, No. 5, p. 515, Sept., 1936.

580 Fifth Avenue,
New York, New York.

Dr. Russell—Has anyone any questions to ask or anything to say about this important subject?

Dr. Stokes—I wonder if the Doctor would tell us something more about the technic he would recommend for companies to use in obtaining the blood for the Kline test. It is not quite clear to me.

Dr. Russell—As there are no other questions, and as I know that Dr. Rein has something more to say, I will ask him to speak for a few moments.

Dr. Rein—The Metropolitan Life Insurance Company has arranged to give to those interested, a mailing case which contains the capillary pipettes, and the complete directions for collecting the blood specimen.

In addition, any company that is interested in doing this test may send their technician to the Metropolitan Life Insurance Company laboratories, or to my laboratories, to learn the details of the test. We shall be very glad to give them whatever help we can.

I had hoped that somebody would ask about the increased mortality among syphilitic individuals. At the present time we are

making a study on the age distribution of a group of syphilitic patients. There is a report in the American Journal of Syphilis by Dr. Gould of Detroit, who finds that the mortality of syphilitics is greatly increased past the age of forty-five. The recent literature contains many references to the increased mortality of syphilitics. Thomas Parran, Jr., Surgeon General of the Public Health Service, writes that each case of syphilis on the average cuts in half the life expectancy of its victim, and that at least 15 per cent. of organic heart disease and 11 per cent. of new admissions to mental hospitals are due to syphilis.

Dr. Neusholm remarks: "Our chief enemies at the present time are heart disease, cancer, pneumonia, tuberculosis and syphilis." If the full facts were known, as Dr. Osler said, syphilis would probably come first. Syphilis is the biggest killing disease in the community. It and tuberculosis are undoubtedly the greatest present contributors to total mortality prior to old age. By removal of tuberculosis and syphilis, most of the preventable deaths at the age of fifteen to sixty-five would be avoided.

Dr. Parran also states that although only a relatively small number of deaths are recorded as due to syphilis, many more are masked under other designations. He states it has been conservatively estimated that 18 per cent. of the deaths from organic heart disease are primarily the result of syphilis. If this is true, the deaths from cardio-syphilis and neurosyphilis far exceed those from tuberculosis.

I assure you that it has been a great pleasure and privilege to again address the members of this Association. If I have been instrumental in starting some of you present to think along the lines of doing routine serologic tests for the detection of syphilis in applicants for insurance, my efforts will be well repaid.

Dr. Russell—We appreciate very much Dr. Rein's coming here and reporting on the work which he is doing. I am sure that from time to time he will give us the results of his further studies.

* * * * * *

I am not sure that we fully appreciate what a debt of gratitude this Association owes to the next speaker and his associates. On

a number of occasions he has graciously accepted our invitations to appear on the program and has invariably presented some brilliant statistical study on one of the most prominent of our underwriting problems. This year Dr. Louis I. Dublin, Third Vice President and Statistician, in collaboration with Mr. Herbert H. Marks of the Statistical Bureau of the Metropolitan Life Insurance Company, has chosen the following subject:

THE WEIGHT STANDARDS AND MORTALITY OF VERY TALL MEN

by

LOUIS I. DUBLIN, PH. D., THIRD VICE PRESIDENT AND STATISTICIAN, AND HERBERT H. MARKS

Metropolitan Life Insurance Company, New York

The exceptionally tall man is an old problem in insurance underwriting. As is the case with all individuals showing marked deviation from the normal, who are relatively so few in number that it is difficult to get a really extensive experience on them, we are inclined to be cautious and sometimes severe. The very tall man is subject to discrimination, also, because of our pre-conceived notions of his general build and the implications of that build. We usually think of him as a thin young man and, consequently, subject to extra risk not only because of his abnormal height, but also because of his underweight. Moreover, in recent years especially, the very tall man has been considered as possibly a victim of pituitary disturbance and, therefore, a potentially bad risk from that point of view.

Extremely tall men, the real giants, it is true, are usually abnormal in many respects. Their great stature often represents, we know now, a true pituitary disorder which is apparent from other physical manifestations than their height. They are short-lived. Dr. Clark[1], in his paper which we were privileged to see in manuscript, cites the facts of the duration of life of seven famous giants recorded in Gould and Pyle's[2] "Anomalies and Curiosities of Medicine."

We are inclined to be rather skeptical regarding the reputed heights of some of these men, but the figures for age at death are probably correct. The average of the ages at death is only 34 years. When one takes into account that these men were probably in their teens before they became objects of attention because of their abnormal heights, their duration of life is very

short indeed. Only two of the seven attained the age of 45 years. On the other hand, little is known regarding those exceptionally tall men, below the class of these freaks, but yet above the moderately tall man, specifically those between 6′ 2″ and 6′ 8″ or so. Only two experiences are available, the Specialized Mortality Investigation[3] and the recent investigation of build and mortality of the Medical Impairment Study[4], neither of which gives much detail, as we shall show later. The earlier study was apparently not unfavorable. The later investigation gave favorable results in those of average weight.

In any case, the tall man has been subject to severe scrutiny and has often had to accept an extra rating, when applying for insurance, that would not be applied to the shorter man. For example, many companies long made it a practice—some still do—to put an extra rating of ten points or more on underweights who are as tall as 6′ 4″ and even greater ratings for overweights of the same height. The companies have not published their practices on heights taller than that, but presumably they are even severer than on men 6′ 4″ in height. This general attitude shows a disregard of the results of the Specialized Mortality Investigation and is probably based on the relatively poor results on moderately tall men in the Medico-Actuarial Mortality Investigation[5] and in the report[6] in 1918 of the Joint Committee of the Medical Directors' and Actuarial Societies. The reasoning evidently was that if the moderately tall did not show up well, the very tall would do even worse, but there was no factual basis for this discrimination. Indeed, if one were to ask what were the specific risks which very tall men run, what diseases take an extra heavy toll among them, one could find no facts because analyses of the causes of death were not made in these investigations.

We, at the Metropolitan, have been in the same position as everyone else regarding the treatment of these tall applicants. We, too, have been severe, but recently we have wondered if we were justified in our practice and we have felt that we should know more about these men. Moreover, the general decline in death rates, due in large part to the improvement in mortality from respiratory diseases (which are among the presumptive

causes of our severity toward tall men), might be expected to improve their position relative to men of shorter heights. Because of these considerations and also because of the paucity of data on very tall men, it was decided to investigate our experience. When we began looking into the material, we discovered that the weight standards commonly used for these taller heights were based on relatively small numbers. We decided, therefore, to study the weights according to height and age in our experience. For this purpose, there were conveniently available the Medico-Analytical cards for the years 1922-1933. We have then for your consideration, first, the data on the build of very tall applicants, those 6′ 2″ or over, accepted for insurance by the Metropolitan Life Insurance Company, and secondly, the facts on their mortality.

We have used both Standard and Substandard cases, excluding from the latter, however, all cases which, according to current practices, were Substandard because of occupation, medical history (except overweight or underweight), or amount of insurance. Our height-weight tables are based on all cases issued during 1922 to 1933 of which we had record, including "not takens" and policies cancelled in the year of issue, although these were automatically excluded in the mortality tabulations which were done by the mean duration method. We have reviewed the literature and have compared our height-weight values with those available, more especially from insurance sources.

Mean and Median Weights

Table 1 gives the mean and median weights of 21,409 men 6′ 2″ and over, accepted for insurance in the Ordinary Department of the Company, classified by inch of height and by age. In addition to the mean and median weights, the table gives the standard errors of these measures and the standard deviations around the mean. Figures for ages 25 and over combined are given, as well as for the separate age groups. We have chosen 25 as the initial age of the combined group because, up to that age, approximately, gains in weight occur as part of the normal growth process. We show separately the figures for the Standard and Substandard

groups combined and for the Standard issues alone. During most of the period covered by this experience, we have card records of only a sample of the Standard cases, and in computing the figures for the combined Standard and Substandard groups, we have made suitable allowance for this situation. The characteristics of the Substandard are not presented separately because it is a heterogeneous group and averages based upon these cases have little meaning by themselves. This group contains, first of all, cases which are rateable because of underweight or overweight, but which, constituting as they do, the two ends of the weight curve, are necessary to give an adequate representation of the distributions for the general category of tall men. The Substandard includes also those cases within Standard limits which were formerly rateable because of occupation or medical history, but are now considered Standard risks, and also a few cases which were rated probably because of "grade".

Before discussing our findings in detail, it should be noted that our crude data show the usual peculiarities of height-weight data from insurance sources. A great many of these men, perhaps the majority, were not weighed or measured. The weights are, in the great majority of instances, reported in figures ending in 0 or 5, and, of the rest, most are given in even figures. There is a tendency to report heights in even inches. In tabulating the weights, we have followed the practice of the Joint Committee in the Medico-Actuarial Mortality Investigation in using groupings centering around 0 and 5, (e.g. 148-152 and 153-157) and the averages were computed on the basis of these groupings.

The total range of height was from 6′ 2″ to 7′ 1″. The only case at the tallest height was under age 25. The numbers of cases diminish very rapidly with increasing height. For that reason the data for the separate age groups were limited to heights 6′ 2″ to 6′ 6″.

The figures show several notable characteristics. First of all, we find the usual increase in the average weight with increasing age. For heights 6′ 2″ to 6′ 4″, these increases are quite marked, averaging about a pound per year of age up to 35, and a half

TABLE 1

Build of Tall Men 6 Feet, 2 Inches and Over
Mean and Median Weights and Standard Deviation of Weights with Their Standard Errors. By Age Groups and Each Inch of Height. Standard and Substandard Cases Combined and Separately.
Metropolitan Life Insurance Company, Ordinary Department, 1922-1933.

Age Groups; Height	NUMBER OF POUNDS						NUMBER OF CASES		
	STANDARD AND SUBSTANDARD CASES COMBINED			STANDARD CASES ONLY					
	Mean	Median	Standard Deviation†	Mean	Median	Standard Deviation†	Total	Standard	Substandard
All Ages, 25&Over									
6'- 2"	185.5± .22	183.1± .28	21.9	183.4± .24	182.1± .30	19.4± .17	9,716	6,513	3,203
6'- 3"	190.6± .52	188.2± .65	23.1	188.2± .56	186.9± .70	20.5± .40	2,016	1,350	666
6'- 4"	195.2± .75	191.7± .95	24.4	192.1± .84	190.2± 1.05	20.6± .59	1,025	607	418
6'- 5"	194.3± 2.43	191.4± 3.05	30.0	191.7± 2.81	191.1± 3.52	27.1±1.99	168	93	75
6'- 6"	193.3± 2.60	192.2± 3.26	28.8	191.3± 3.15	192.2± 3.95	25.8±2.23	144	67	77
6'- 7"	176.0± 7.13	165.7± 8.94	30.0	*	*	*	20	8	12
6'- 8"	190.7± 5.75	194.7± 7.21	21.7	*	*	*	17	5	12
6'- 9"	*	*	*	*	*	*	4	3	1
6'-10"	*	*	*	*	*	*	1	1	-
6'-11"	*	*	*	*	*	*	1	1	-
Under 20									
6'- 2"	166.0± .41	164.2± .51	18.2	166.4± .43	164.8± .54	15.3± .31	1,893	1,252	641
6'- 3"	170.4± .90	168.2± 1.13	18.9	170.9± .98	169.3± 1.23	15.5± .69	429	251	178
6'- 4"	174.4± 1.23	165.2± 1.54	19.1	175.1± 1.36	174.0± 1.71	15.4± .96	234	128	106
6'- 5"	171.4± 5.17	174.0± 6.48	23.9	169.7± 6.10	174.2± 7.65	24.4±4.31	28	16	12
6'- 6"	174.1± 5.84	171.3± 7.32	25.4	*	*	*	23	8	15
20-24									
6'- 2"	173.6± .28	171.4± .35	17.6	173.0± .30	171.4± .37	15.4± .21	4,141	2,683	1,458
6'- 3"	177.7± .64	175.5± .80	19.3	176.8± .69	175.3± .86	16.1± .49	896	545	351
6'- 4"	182.8± 1.00	180.0± 1.25	21.9	181.7± 1.07	180.1± 1.35	17.9± .76	462	278	184
6'- 5"	185.9± 2.45	181.6± 3.07	22.1	185.5± 2.96	182.0± 3.71	18.0±2.09	88	37	51
6'- 6"	187.7± 2.65	186.6± 3.32	20.7	189.5± 3.21	188.8± 4.03	17.3±2.27	67	29	38
25-29									
6'- 2"	179.9± .35	177.8± .44	20.2	178.4± .37	177.2± .47	17.7± .27	3,409	2,237	1,172
6'- 3"	184.9± .78	182.0± .98	21.0	183.1± .85	181.0± 1.06	18.8± .60	736	491	245
6'- 4"	189.9± 1.18	187.8± 1.48	22.8	187.5± 1.29	186.3± 1.61	19.0± .91	362	218	144
6'- 5"	189.0± 3.60	186.1± 4.51	25.9	186.0± 4.46	185.6± 5.59	24.0±3.15	63	29	34
6'- 6"	196.1± 3.91	197.6± 4.91	24.8	197.1± 4.90	198.1± 6.14	20.2±3.46	45	17	28

TABLE 1—Continued

Age Groups; Height	NUMBER OF POUNDS						NUMBER OF CASES		
	STANDARD AND SUBSTANDARD CASES COMBINED			STANDARD CASES ONLY					
	Mean	Median	Standard Deviation†	Mean	Median	Standard Deviation†	Total	Standard	Sub-standard
30-39									
6′- 2″	186.3± .33	184.4± .42	22.0	184.1± .36	183.2± .45	19.1± .25	4,190	2,841	1,349
6′- 3″	190.2± .75	187.8± .94	22.6	187.6± .81	186.4± 1.02	19.3± .58	826	564	262
6′- 4″	196.7± 1.14	193.1± 1.43	24.7	193.8± 1.27	191.6± 1.59	21.0± .90	454	275	179
6′- 5″	197.0± 3.70	197.5± 4.64	28.6	195.0± 4.18	198.3± 5.23	25.4±2.95	65	37	28
6′- 6″	196.5± 4.04	193.4± 5.07	30.0	193.6± 4.86	192.5± 6.09	27.5±3.44	65	32	33
40-49									
6′- 2″	192.4± .56	191.0± .71	23.7	189.6± .61	189.0± .76	20.4± .43	1,644	1,119	525
6′- 3″	200.9± 1.38	199.7± 1.72	24.8	198.5± 1.51	198.6± 1.89	22.3±1.07	336	219	117
6′- 4″	199.7± 1.95	197.3± 2.44	25.5	195.4± 2.21	193.8± 2.77	20.6±1.56	159	87	72
6′- 5″	197.1± 6.23	192.1± 7.81	33.7	193.9± 6.76	190.0± 8.47	31.7±4.78	31	22	9
6′- 6″	184.7± 5.54	185.0± 6.94	28.3	182.2± 6.28	180.0± 7.87	25.1±4.44	28	16	12
50-59									
6′- 2″	194.0± 1.09	192.1± 1.36	22.6	191.4± 1.18	190.7± 1.48	20.1± .84	434	290	144
6′- 3″	199.3± 2.32	197.9± 2.90	25.5	194.9± 2.54	192.0± 3.18	20.6±1.79	106	66	40
6′- 4″	204.9± 3.84	206.4± 4.82	27.1	199.4± 4.45	202.5± 5.58	22.7±3.15	47	26	21
6′- 5″	*	*	*	*	*	*	8	5	3
6′- 6″	*	*	*	*	*	*	6	2	4
60 and Over									
6′- 2″	194.3± 4.12	192.9± 5.17	24.7	191.0± 4.61	190.8± 5.78	23.5±3.26	39	26	13
6′- 3″	201.8± 7.21	200.7± 9.03	24.9	200.0± 7.56	200.0± 9.47	23.9±5.34	12	10	2
6′- 4″	*	*	*	*	*	*	3	1	2
6′- 5″	*	*	*	-	-	-	1	-	1

†Standard error based on the assumption of normal distribution of frequencies.
*Not significant because of small number of cases.

pound from then to about age 45, after which the increases are quite small. At the taller heights the increases are marked only up to age 35; after that age they are practically nil. The age at which the weight increases cease varies somewhat at each inch of height, but the attainment of maximum weight at a relatively early age is apparently typical of the very tall man.

The average weights show also a characteristic increase with height from 6′ 2″ to 6′ 4″, but above that height the increases are

small, less than the standard error of the difference between one height and the succeeding height, or disappear altogether. This is one evidence that these very tall people tend to conform to a linear type. The increases in the average weight with height in this experience are somewhat less than that allowed for in the standard tables.

The standard deviation is a measure of the dispersion of the weights around the mean. Approximately two-thirds of the cases will be found to lie within the interval of the mean minus the standard deviation and the mean plus the standard deviation. For example, taking cases 6′ 2″ at ages 25 and over, approximately two-thirds of them will be between 163.6 pounds (=185.5—21.9) and 207.4 pounds (=185.5+21.9). For tall men in the various height and age groups most of these values fall between 18 and 25 pounds which means that over two-thirds of the cases in most groups will fall within a range of 36 to 50 pounds. The first significant fact regarding the standard deviations is that the lowest values are recorded at the younger ages. This is to be expected because the extremes of weight, especially on the overweight side, do not occur at young ages and, consequently, there is relatively less variation from the average weight at these ages. It will next be noted that as in the case of the mean, the figures for the standard deviation increase with height, but this increase tends to fall off or disappear at the greater heights. This, we believe, indicates a definite build tendency in these tall men which, we have said before, is evidence of the conformity of tall people to a common type of build to a greater extent than is found in persons of shorter height.

Comparison of Means and Medians

In general, the median weights approximate the means, but except for a few numerically small groups, are 2 to 3 pounds less than the means. The reason for this consistent variation is that the curve of weight is what we call "skewed," declining from the peak value less steeply on one side of the curve than on the other. There is greater variation on the side of overweight than of

underweight. Average weights generally give values that are too high to serve as norms. Median weights come closer to "ideal" weights and to a certain degree, they are better as representative weights than are the means. They are presented in the table for that reason.

Combined Standard and Substandard as Compared with Standard Only

The tables of average weights, derived from insurance material, are usually based on Standard cases only. Excluding as they do the more extreme values of underweight and overweight, more especially the latter, they fall short of being representative. Nevertheless, in addition to the data for the group as a whole, we give also the averages based on Standard cases alone because they have been used in the past and because some may prefer them. It will be noted that, at the younger ages, when underweight is more severely rated, the Standard averages are about the same or slightly higher than the averages for the combined groups, but at the older ages when overweight is more frequently rated, the Standard averages are lower than the combined.

Comparison of Metropolitan Average Weights with Those of Other Tables

Data on the average weights of very tall men, according to age, have been collected from various sources[7-15] and are summarized in Table 2, together with the Metropolitan data for the combined Standard and Substandard and for the Standard alone. Minor differences in age grouping have been disregarded. Except for our experience, most of these averages are based on relatively limited numbers. The Medico-Actuarial averages[7] at 6′ 2″ are based on only 2,342 men of all ages; at 6′ 3″ on 669 men; at 6′ 4″ on 229 men; and at taller heights on only 79 men. Diehl's[8] observations on tall college men are fairly numerous for the ages 16 to 21, but in this short period of life, growth is still a factor.

As compared with earlier American insurance data, the Metropolitan average weights are almost invariably lower. At the

younger ages, the differences are small. At ages under 25 the averages, both for total cases and the Standard only, are usually no more than 2 pounds lower than the new Medical Impairment Study Table[9] and the Medico-Actuarial Table. At these ages, our averages are much lower than those of the earlier Shepherd

TABLE 2

Comparative Average Weights of Tall Men 6 Feet, 2 Inches and Over By Inch of Height and Age Groups

	Age Group										
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69
6 Feet, 2 Inches											
1. Metropolitan Life Insurance Co., 1922-1933											
Total, Standard and Substandard	166	174	180	186		192		194		194	
Standard only	166	173	178	184		190		191		191	
2. Medical Impairment Study, 1909-1927											
Crude	167										
Graded	168	173									
3. Medico-Actuarial Mortality Investigation, 1885-1908											
Crude	171	174	181	186	193	194	199	199	186	*	*
Graded	168	173	181	186	191	194	197	198	198		
4. Shepherd, 1897	176		184	188	192	194	196	194	194	192	192
5. National Fraternal Congress, 1901	176		184	188	192	194	198	194			
6. Combined German Companies		173	186	188	187	198	194	198			
7. Scottish Life, 1881-1915†	162	170	178	184	188	192	195	198			
8. 7 British Life Offices, 1921-1922†	157	164	170	175	180	183	186	188	190		
9. U. S. Army Officers, 1928‡		172	176	181	186	188	188	191	190		
10. Students of 10 colleges‡	165	169**									
6 Feet, 3 Inches											
1. Metropolitan Life Insurance Co., 1922-1933											
Total, Standard and Substandard	170	178	185	190		201		199		202	
Standard only	171	177	183	188		199		195		200	
2. Medical Impairment Study, 1909-1927											
Crude	171										
Graded	173	178									
3. Medico-Actuarial Mortality Investigation, 1885-1908											
Crude	*	177	186	192	197	200	200	206	*	*	*
Graded	173	178	187	192	197	201	204	205	205		
4. Shepherd, 1897	181		190	195	200	203	204	201	198		
5. National Fraternal Congress, 1901	181		190	195	200	203	204	201			
9. U. S. Army Officers, 1928‡	176		180	186	190	193	193	195	195		
10. Students of 10 colleges‡	170	171**									

TABLE 2—Continued

Comparative Average Weights of Tall Men 6 Feet, 2 Inches and Over By Inch of Height and Age Groups

	Age Group										
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69
6 Feet, 4 Inches											
1. Metropolitan Life Insurance Co., 1922-1933											
Total, Standard and Substandard	174	183	190	197		200		205			*
Standard only	175	182	188	194		195		199			*
2. Medical Impairment Study, 1909-1927											
Crude	177										
Graded	178	183									
3. Medico-Actuarial Mortality Investigation, 1885-1908											
Crude	*	190	194	199	204	211	202	*	*	*	
Graded	178	183	192	198	203	208	211	212	212		
9. U. S. Army Officers, 1928‡		180	184	190	195	198	198	200	199		
10. Students of 10 colleges‡	171	177**									
6 Feet, 5 Inches											
1. Metropolitan Life Insurance Co., 1922-1933											
Total, Standard and Substandard	171	186	189	197		197		*			*
Standard only	170	186	186	195		194		*			–
2. Medical Impairment Study, 1909-1927											
Crude	183										
Graded	183	188									
3. Medico-Actuarial Mortality Investigation, 1885-1908											
Crude		*	195	211		213		*			
Graded	183	188	197	203	209	214	217	218	219		
9. U. S. Army Officers, 1928‡		184	188	195	200	202	202	204	204		
10. Students of 10 colleges‡	178	178**									
6 Feet, 6 Inches											
1. Metropolitan Life Insurance Co., 1922-1933											
Total, Standard and Substandard	174	188	196	197		185		*			–
Standard only	*	190	197	194		182		*			–
10. Students of 10 colleges‡	176	*									

* Less than 10 cases.
**Ages 20-21.
† Graded table.
‡ Average net weights of original tables corrected by adding 1 inch to height and 8 pounds to weight.

Table[10] and the National Fraternal Congress Table[11]; they are practically the same as in the German Table[12], but considerably higher than those in the British[13-14] insurance tables. They are likewise high as compared with the figures for college students.

Past age 25 the differences between these Metropolitan figures and earlier American insurance tables grow appreciably greater. The average difference is at least 5 pounds. The greater differences are recorded at ages past 40 and at the taller heights. Our Metropolitan averages at ages past 35 are intermediate between the two British insurance tables, in both of which the greatest height shown is 6′ 2″, and which differ considerably from each other. Our averages are consistently higher with but minor exceptions, than the averages for United States Army officers[15].

Mortality

The only earlier data on the mortality of men taller than 6′ 2″ are, as we have indicated, those of the old Specialized Mortality Investigation and of the Medical Impairment Study. The former covered the experience on 5,433 men "Height above 6 feet, 3 inches" insured in various companies during the years 1869 to 1899, and traced to the policy anniversary in 1900. The results, which run counter to the general view, are summarized in the report as follows: "The younger entrants have been good risks and the older bad." The mortality standard in this study was Farr's Healthy English Table, modified upwards at ages 52-61 and also slightly downward at ages 15-21, but at the younger ages only "such as appeared to be necessary to complete the table by a natural gradation." At all ages combined, the ratio of actual to expected deaths was 99.6 per cent., a mortality almost exactly equal to the standard. Younger risks, ages at issue 15 to 28, had a mortality ratio of 95.1 per cent., and those aged 29 to 42, 87.6 per cent., compared with mortalities of 114.2 per cent. at ages 43 to 56 and 150.9 per cent. for issues at ages 57 to 70, the last ratio being based, however, on only 16 deaths. The ultimate experience was not essentially different from the total.

On the surface, the Specialized Mortality Investigation showed cause for careful handling of only those exceptionally tall men who were past age 40. The results, however, must be taken with reserve, especially as regards the younger risks. For, Weeks[16] showed that, on the basis of the summation of the best 27 classes of risks in the Investigation, which included many groups of im-

paired lives, the mortality table used as a standard was too generous at ages under 45, but probably suitable past 50. The conclusions of the study as regards these tall men, therefore, were open to question. No attempt was made, however, to test the material anew, on the basis of a contemporaneous insurance mortality experience, to see how much of an excess mortality would be found for these younger cases.

The mortality experience on men 6′ 3″ and over, made in connection with the Medical Impairment Study, is likewise not very instructive. This experience covered issues during the years 1909-1927, carried to the 1929 anniversary. The only detail shown is by broad weight groups at issue. The group consisting of all underweights and those less than 10 per cent. overweight had a normal mortality, 99 per cent. of the Basic Table, based on 63 deaths. The mortality of overweights was very much higher, namely, 174 per cent. of the Table. While some degree of excess mortality was to be expected, the contrast in this experience is surprising.

In the Medico-Actuarial Mortality Investigation, the subsequent Joint Committee report of 1918, and the Medical Impairment Study of 1929, the facts on the very tall men were discarded, except for the brief analysis of such cases in the last named study. The tall group in those studies was limited to heights 5′ 11″ to 6′ 2″ and only a small part of the material pertained to the tallest height. We may then dismiss briefly the findings of those investigations. The Medico-Actuarial results by broad height groups, without distinction as to weight, are summarized in Table 3. This table shows that there was from a moderate to a "borderline" excess mortality for these tall men at the younger ages. At the later ages they showed up better than the rest. Analyzed further by departures from average weight, it was found that the tall men had mortalities bordering on the Substandard, if they were young and appreciably underweight or overweight. At ages past 30, however, only those who were appreciably overweight could be considered poor risks.

The findings of the Joint Committee, which made use largely of Medico-Actuarial Investigation material, were summarized in the pamphlet, Standard Mortality Ratios Incident to Variations in

Height and Weight Among Men. These follow pretty much the same trend as the Medico-Actuarial findings and need not be discussed in detail. We might also mention at this point the table, "Limits of Overweight Corresponding to Certain Mortality Ratios," prepared by Dr. Knight[17] and Dr. Dublin for use at the Metropolitan, which was based on the Joint Committee report. This table provided a small basic rating on all risks under 40 who were over 5′ 10″ in height. The results of the investigation of

TABLE 3

Mortality According to Height
Medico-Actuarial Mortality Investigation, 1885 to 1909
Ratio of Actual to Expected Deaths According to the Medico-Actuarial Mortality Table

Ages at Issue	Per cent. Actual of Expected Deaths		
	5 ft. 3 in. to 5 ft. 6 in.	5 ft. 7 in. to 5 ft. 10 in.	5 ft. 11 in. to 6 ft. 2 in.
20–29	96	110	122
30–39	107	109	113
40–49	110	109	120
50–59	108	109	101

the group 5′ 11″ to 6′ 2″ in connection with the recent Medical Impairment Study were very much like those of the earlier studies. If anything, these moderately tall men showed up a little better than before.

The Mortality Results of the Present Investigation

From our review of the literature, it is obvious that a study of the mortality of exceptionally tall men is needed. The present analysis of the Metropolitan experience is based very largely on recent issues and, despite the fact that a great part of it is within the select period, we believe that it gives a good picture of the mortality of these men. The study is based on 12,614 Standard cases and 6,345 Substandard cases accepted for insurance during

1922 to 1933 and traced to the anniversary in 1935. As we have indicated earlier, the Standard cases represent only a sample for most of the period covered. The Substandard group, the heterogeneous nature of which has already been described, takes in all cases suitable for inclusion in the study. The results on the Standard and Substandard are presented separately. As the mortality standard for the study we have used the Basic Mortality Table, 1920-1934 which was made up for the current studies of the Medico-Actuarial Committee. This mortality table is roughly contemporaneous with our own experience and is, especially at the younger ages, a severe standard. Table 4 gives the results of our study of the mortality of all these men, 6′ 2″ and over in height.

On the Standard cases, as a group, there was a total exposure of 71,292 years of life. The total number of deaths was 280. These Standard cases give a practically normal mortality, namely, 100.3 per cent. of the expected. The mortality in the first five years, which comprised nearly two-thirds of the total exposed to risk, was somewhat worse than the ultimate, but the ratios of both were within 10 per cent. of the expected. The younger risks, those under age 30, showed up appreciably worse than the older risks. Their mortality, 117.2 per cent. of the expected, approaches the borderline permissible for Standard insurance. On these younger risks there was little difference between the mortality ratios of the first five and later experience years. For risks between 30 and 39 at issue, a slight excess mortality was recorded, due entirely to the relatively poor experience in the early years after issue. For risks over 40 the experience has been good, both in the select and ultimate periods.

For the Substandard cases the mortality was appreciably higher than that of the Standard risks. In a total exposure of 29,334 years of life, there were 159 deaths or 147.2 per cent. of the number expected by the Basic Table. The relatively high mortality of the Substandard group is not surprising, first because it includes the extreme cases of overweight and underweight and, secondly, because the remainder consisting largely of cases on which occupational and medical ratings have been lowered in

recent years, might be expected to have a mortality close to "borderline". In the Substandard group the mortality ratio in the later insurance years, 126.4 per cent., was just beyond the limit permissible for Standard. This was considerably better than the mortality of 161.1 per cent. in the early years after issue. In contrast to the Standard group, the mortality ratios in the Sub-

TABLE 4

Mortality of Tall Men, 6 Feet 2 Inches and Over
Ratio of Actual to Expected Deaths by Basic Mortality Table, 1920-1934
By Age Groups at Issue. Standard and Substandard Issues Separately

Ages at Issue	Years of life exposed to risk	Deaths	Per cent. Actual of Expected Deaths		
			Aggregate	First five insurance years	Sixth and later insurance years
Standard					
All Ages	71,292	280	100.3	108.7	91.9
Under 30	40,989	107	117.2	117.3	116.9
30–39	19,431	77	104.9	118.9	92.0
40–49	8,397	62	90.3	92.3	88.8
50 and over	2,475	34	74.2	92.8	59.2
Substandard					
All Ages	29,334	159	147.2	161.1	126.4
Under 30	17,103	50	136.6	127.7	156.0
30–39	7,787	43	154.5	185.9	114.4
40–49	3,345	40	161.5	189.0	127.2
50 and over	1,099	26	138.0	168.0	103.2

standard are highest in the middle ages at issue, namely, from 30 to 50. As we shall see later, this is caused primarily by the unfavorable experience on overweights at these ages. Except for issues at ages under 30, the ratios in the sixth and later insurance years were appreciably lower than in the earlier years.

The mortality experience was studied separately for individual inches, 6′ 2″ to 6′ 4″, and for the group 6′ 5″ and over combined. This combination was necessary because the material was inadequate for detailed treatment at the tallest heights. The results of this analysis are given in Table 5. It was found that among men 6′ 2″ in height, who constituted the bulk of the experience, the results were pretty much the same as reported for the total experience on tall men. Among Standard cases the ratio of actual to expected deaths was a trifle lower than for the total experience, but there were some slight differences in detail which may be mentioned. Thus, the mortality on issues at ages under 30 was somewhat worse than in the total Standard experience at these ages. The mortality ratio for these cases, 125.2 per cent., was actually at the borderline permissible for Standard risks. The relatively poor result in this group was largely concentrated in the sixth and later experience years. On issues between ages 30 and 50, the men, 6′ 2″ in height, had lower mortality ratios than is found in the total experience on tall men at these ages. After age 50 the reverse was true, but the mortality experience was nevertheless satisfactory, showing a ratio of actual to expected deaths of only 85.4 per cent.

The experience on Substandard risks 6′ 2″ in height was slightly worse than the total Substandard experience on tall men. The only differences in detail, worthy of note, are the increases, as compared with the total Substandard experience, in the mortality ratios on issues at ages 40 to 49 and in the ratio, at all ages, in the sixth and later years after issue, which, for this height group, is the same as that in the earlier years.

Men 6′ 3″ in height, accepted for Standard insurance, had a favorable experience. Their mortality, based on 45 deaths, was only 90.0 per cent. of the expected. The experience was favorable in both the first five insurance years and in the later years. The ratios by age showed wide variations, but the amount of experience was generally small and not much reliance should be placed on the individual ratios of actual to expected deaths. It may be noted, however, that at ages under 30 where there was a sizeable experience, the mortality has thus far been favorable. The Sub-

standard risks 6′ 3″ in height likewise showed up better than the total Substandard experience on very tall men. Unlike the Standard cases, the experience has been rather bad on the younger risks but favorable for issues after age 40.

TABLE 5

Mortality of Tall Men 6′ 2″ and Over in Detailed Height Groups Ratio of Actual to Expected Deaths by Basic Mortality Table, 1920-1934. By Age Groups at Issue. Standard and Substandard Issues Separately

Height; Ages at Issue	STANDARD					SUBSTANDARD				
	Years of life exposed to risk	Deaths	Per cent. Actual of Expected Deaths			Years of life exposed to risk	Deaths	Per cent. Actual of Expected Deaths		
			Aggregate	First five Ins. years	Sixth and later Ins. years			Aggregate	First five Ins. years	Sixth and later Ins. years
6 Feet, 2 Inches										
All Ages	52,474	200	98.3	100.2	96.3	20,555	115	154.9	154.7	155.1
Under 30	30,178	84	125.2	110.2	147.1	12,009	35	136.3	119.0	174.1
30–39	14,256	52	96.9	114.5	80.0	5,466	30	154.5	162.5	143.9
40–49	6,300	37	72.3	69.7	74.4	2,369	34	198.0	214.5	176.2
50 and over	1,740	27	85.4	94.9	77.2	711	16	133.4	148.6	114.1
6 Feet, 3 Inches										
All Ages	12,146	45	90.0	94.9	85.9	4,933	24	121.8	178.4	55.2
Under 30	7,052	11	69.0	90.7	*	2,865	10	162.3	169.9	*
30–39	3,214	15	123.0	106.8	136.8	1,247	9	198.7	340.4	*
40–49	1,348	15	131.3	128.8	133.1	608	2	*	*	–
50 and over	532	4	*	*	*	213	3	*	*	*
6 Feet, 4 Inches										
All Ages	5,193	27	141.1	195.7	84.8	2,595	13	135.4	165.3	*
Under 40	4,577	16	127.4	162.5	86.4	2,209	5	85.6	*	*
40 and over	616	11	167.2	272.1	*	386	8	212.3	254.2	*
6 Feet, 5 Inches and Over										
All Ages	1,479	8	123.3	225.1	*	1,251	7	155.9	192.3	*
Under 40	1,143	6	186.9	352.9	–	1,094	4	*	*	*
40 and over	336	2	*	*	*	157	3	*	*	*

*Ratio not significant because of small number of deaths.

The experience on Standard risks, 6′ 4″ in height, has been poor. The ratio of actual to expected deaths was 141.1 per cent., based on 27 deaths. The mortality was somewhat worse for issues after 40 than under that age. The smaller experience on Substandard risks at this height was below the average for the Substandard experience on tall men, and practically the same as the experience on Standard cases at this height.

The small experience on the very tallest risks, those 6′ 5″ and over, accepted for Standard, has been rather high, namely, 123.3 per cent. of the expected, based on only 8 deaths. The Substandard experience at this height gave a mortality of 155.9 per cent., based on 7 deaths, or a little above the average for the Substandard experience on tall men but not at all different from the experience on those 6′ 2″ in height. The variations in mortality, according to time elapsed since issue and according to age, are not significant because of the small amount of experience. It may be noted, however, that the Standard experience has been bad at ages under 40.

Mortality According to Weight

We have further analyzed the mortality of these tall men according to weight groups. Each weight group covers a 20 pound range, except those at either end. We have used the same groupings for all heights because the range of height was relatively small, and this method made for ease and simplicity in tabulation. In this classification, we have recognized the peculiar way in which the weights were reported, namely, the high percentage with figures ending in 0 and 5. In order to have samples of sufficient size, we have made no distinction as to inch of height. The results are summarized in Table 6.

Very few of these cases were under 143 pounds and the small experience on both Standard and Substandard has thus far been all right. In the next weight group, underweights between 143 and 162 pounds, a slight excess mortality has been recorded in Standard cases. The mortality in the early insurance years was good, but in the later years rather high. The issues at younger ages did as well as the older ones. The Substandard cases in this weight group, however, have done badly, especially in the first five years after issue. The later experience was much better. The younger risks have shown up no worse than the others, and in fact a little better. It is likely that the average weight of the Substandard risks in this weight group is lower than that of the Standard, and this may, in part, account for the difference between the two.

In the next weight group, 163-182 pounds, which comprises the moderately underweight cases, the Standard experience has again been good, showing only a slight excess over the expected, namely, 104.2 per cent. The mortality in the early years was high, but this was counter-balanced by the favorable showing of the later insurance years. At ages under 30, the mortality has been rather close to borderline, and even at 30 to 39 was a little high, owing to the poor experience in the years immediately after issue. In the later insurance years, the experience has been uniformly satisfactory. Substandard cases in this weight group, 163-182 pounds, showed a mortality appreciably above the expected, but the ratio of actual to expected deaths, 126.9 per cent., is only slightly above the limit permissible for Standard risks. We believe that this excess has little to do with the height or weight of these risks, but reflects the general composition of the group, which is really "borderline" because of occupation, medical history or "grade". Among the Substandard cases, in this weight group, the mortality ratio for the first five insurance years was somewhat lower than for the later years. The younger risks have done rather better than the others.

Standard cases in the group weighing between 183 and 202 pounds, which represents the average weights, had a very satisfactory mortality record, 86.6 per cent. of the expected, based on 71 deaths. The experience was good, regardless of time since issue. The younger risks, however, had a mortality close to "borderline", namely, 123.3 per cent. of the expected. The older risks showed up very well indeed. The average weight Substandard cases had a mortality ratio of 122.8 per cent. of the expected, again practically "borderline". The reason, we believe, is the same as cited for the preceding weight group. The experience was slightly better in the early years after issue. The mortality was high only for issues under age 30. The experience at the other ages was satisfactory.

The moderately overweight tall men, those weighing between 203 and 222 pounds, who were accepted for Standard, also had a satisfactory mortality record, namely, 102.1 per cent. of the expected, based on 46 deaths. The experience was better with

TABLE 6

Mortality of Tall Men 6 Feet 2 Inches and Over
Ratio of Actual to Expected Deaths by Basic Mortality Table, 1920-1934.
By Weight Groups and Age Groups at Issue.
Standard and Substandard Issues Separately.

Weight Groups; Ages at Issue	STANDARD					SUBSTANDARD				
			Per cent. Actual of Expected Deaths					Per cent. Actual of Expected Deaths		
	Years of life exposed to risk	Deaths	Aggregate	First five Ins. years	Sixth and later Ins. years	Years of life exposed to risk	Deaths	Aggregate	First five Ins. years	Sixth and later Ins. years
Under 143 lbs.										
All Ages	882	1	*	*	..	1,419	2	*	*	..
143–162 lbs.										
All Ages	13,316	43	107.5	84.3	134.0	4,317	23	213.2	253.3	*
Under 30	9,993	24	108.8	77.0	154.4	3,643	15	199.5	233.4	*
30–39	2,416	7	78.4	*	*	499	3	*	*	*
40–49	754	6	101.7	*	*	124	2	*	*	..
50 and over	153	6	191.7	*	*	51	3	*	*	..
163–182 lbs.										
All Ages	27,492	99	104.2	125.4	82.0	7,412	29	126.9	121.4	134.4
Under 30	18,153	49	121.2	134.9	101.8	5,179	10	88.1	*	183.9
30–39	6,449	27	111.3	154.0	71.6	1,667	10	169.2	273.6	*
40–49	2,255	12	65.3	74.0	58.4	427	4	*	*	*
50 and over	635	11	92.3	97.5	88.4	139	5	211.9	*	*
183–202 lbs.										
All Ages	18,872	71	86.6	85.9	87.3	5,504	25	122.8	114.2	133.6
Under 30	9,056	25	123.3	106.8	148.0	3,146	13	188.1	137.0	276.7
30–39	6,266	18	76.3	86.3	66.6	1,571	5	89.0	*	*
40–49	2,640	21	99.9	94.7	104.2	584	4	*	*	*
50 and over	910	7	40.9	*	*	203	3	*	*	*
203–222 lbs.										
All Ages	8,846	46	102.1	118.1	86.8	2,998	17	131.5	179.8	*
Under 30	2,859	8	122.1	159.2	*	1,400	2	*	*	..
30–39	3,498	17	128.1	136.6	119.8	1,006	6	172.4	*	*
40–49	1,911	13	83.8	72.3	93.1	448	7	211.5	333.3	*
50 and over	578	8	82.2	126.6	*	144	2	*	*	..
223–242 lbs.										
All Ages	1,767	19	147.1	199.6	108.0	5,183	42	174.3	184.7	158.4
Under 30	309	1	*	*	..	1,744	6	162.2	183.8	*
30–39	541	6	267.9	*	*	2,015	12	166.7	163.9	170.6
40–49	740	10	156.3	223.9	*	1,146	16	186.5	191.1	180.9
50 and over	177	2	*	*	..	278	8	173.5	205.5	*
243 lbs. and over										
All Ages	117	1	*	..	*	2,501	21	152.6	176.8	119.9
Under 30	..	..	..	..	..	738	2	*	*	..
30–39	..	..	*	..	*	922	7	198.9	333.3	*
40–49	..	..	..	..	..	563	7	169.5	*	*
50 and over	..	..	..	..	..	278	5	109.6	*	*

*Ratio not significant because of small number of deaths.

increasing duration of insurance. At ages under 40, however, the mortality of these risks came close to the borderline permissible for Standard risks. The older risks have done well. The small Substandard experience was 131.5 per cent. of the Basic Table, or a few points more than "borderline", as was the case for the slightly underweight and average weight men limited to Substandard insurance. The ratios varied widely according to duration and age, but the differences are not stressed because the amount of material in these detailed groups was too small.

In the weight group 223-242 pounds, which represents an appreciable excess over average weight, the mortality on the small Standard experience has been unfavorable. The 19 deaths recorded were 147.1 per cent. of the expected, well beyond the limits permissible for Standard risks. We have probably been too generous in the treatment of these overweights and the result is not surprising. This group is too small, however, to yield significant differences, according to duration of insurance or age. The Substandard experience on men in this weight group, which is much larger than the Standard, has been even worse, 174.3 per cent. of the Basic Table. Some excess of mortality was expected because most of these men were rated on account of their weight. The experience was poor regardless of duration of insurance or age, although it was generally a little better in the later insurance years.

At the heavier weights, over 242 pounds, the Standard experience was small, as would be expected and of no significance. Practically all such overweight cases are rateable because of their weight. The Substandard cases gave a mortality well above normal, 152.6 per cent. of the expected, based on 21 deaths. For a group as much overweight as these men, however, it is not a really bad experience. It may be noted that their mortality is about that for all the Substandard cases in this experience, and actually, though not significantly better than the weight group just below it. Because of the limited size of this experience on obese tall men, the variations in the mortality ratios by duration of insurance and by age cannot be stressed.

Causes of Death

The essential normality of the experience on these tall men is illustrated by the analysis of the principal causes of death among them. In the group accepted for Standard insurance, the distribution of the causes of death was very much like that which prevails among Standard risks in general. Unfortunately, exact measurement of expected mortality according to cause cannot be made because the necessary data are not available in connection with the standard mortality tables. We have made a test, however, necessarily rough, based upon the mortality in our Ordinary Department during 1922-1933 on policies in force over five years. With due regard to the limited size of our sample and the exclusion of the select period in our test standard, none of the important causes of death among the tall men showed a significant excess mortality. Of outstanding interest are the findings regarding respiratory diseases. The death rate from tuberculosis was definitely low, accounting for only 29 of the 280 deaths, or but little more than 10 per cent. of the total mortality. On the basis of our general experience, nearly 50 would be expected, and even allowing for a low mortality from the disease during the select period, the expected number would be at least about 40. The mortality from influenza and pneumonia was practically normal, accounting for 27 deaths, about the same number as from tuberculosis. The death rates for the degenerative diseases were approximately normal, except nephritis, which was rather low. Deaths from violence, likewise, showed no significant departure from normal. Deaths from cancer and appendicitis were slightly more numerous than expected, but the numbers are too small to attach any significance to the excess recorded.

Further analysis by attained ages under and over 45 showed that, among the Standard cases, the mortality from tuberculosis at ages under 45 was much lower than expected. Only influenza and pneumonia, and cancer showed mortalities above normal at these ages, but it is doubtful whether much, if any, significance can be placed on these results. At ages 45 and over, none of the

diseases showed a significantly high death rate. The mortality from violent causes was relatively high.

Among the Substandard cases, the excess mortalities recorded for individual causes of death were pretty much what one would expect when one takes into account the diverse nature of the group, including at the one extreme underweights who were suspect and, at the other extreme, the rateable overweights and "borderline" risks. So far as tuberculosis is concerned, the experience has been exceptionally good. Only 11, or 7 per cent. of the total of 159 deaths were due to tuberculosis. On the basis of our general experience in the Ordinary Department, about 20 tuberculosis deaths would be expected. The death rate from influenza and pneumonia, on the other hand, was high. The 18 deaths from these causes far exceeded those from tuberculosis and gave a mortality about 50 per cent. higher than expected. The death rates from the degenerative diseases were also high in the Substandard group, but this is not unexpected because of the large proportion of overweights in the group. The greatest excess death rate was recorded for accidents due, we believe, to the high death rate among those risks for whom occupation ratings have changed in recent years, because, despite a normally high accident rate, their total mortality was within Standard limits. All forms of violence accounted for 41 deaths, or one-fourth of the total and more than the number recorded from any other cause. In view of the essentially normal accident experience on the Standard cases, we are not inclined to place much significance on the excessive mortality from violence in the Substandard cases.

When the causes of death among the Substandard cases are considered by age, it is found that the death rate from tuberculosis under 45 was low, but that from influenza and pneumonia definitely high. Apart from the high mortality from accidental causes, there is nothing else worthy of comment. At ages over 45, there were no deaths at all from tuberculosis and the mortality from influenza and pneumonia was practically normal. Deaths from degenerative diseases and from violent causes were

high, but we have already touched on the reasons for their high death rates.

The causes of death have also been studied according to detailed height classes but there were no special features of interest. In both the Standard and Substandard groups, there were indications of a rather high mortality from the respiratory diseases among the taller risks, but the number of deaths was too small to warrant any definite conclusion in the matter. Heart disease likewise showed an excess mortality in both groups, but since the mortality from other types of degenerative diseases was low, we are inclined to dismiss these variations as unimportant.

We have also analyzed the causes of death according to the weight groups, defined earlier. We found that, in the Standard group, the mortality from respiratory diseases was higher among the lighter weight men than among the overweights, but in none of the underweight groups were the figures seriously high. The overweights, as is usual, suffered relatively high death rates from the degenerative diseases. Likewise, among the Substandard issues, the most notable features were the relatively high mortality from respiratory diseases among the underweights, and the increasingly high mortality from degenerative diseases with increasing weight. Since these are usual findings in analyses of mortality by build classes, we believe that these unfavorable features of the experience should be viewed as due more to departures from average weight than to excess height. The few deaths from diabetes occurred among the overweights. The death rate from violent causes was generally high in all the weight groups among these Substandard risks.

Summary and Conclusions

1. The ungraded mean and median weights of men 6′ 2″ in height or over, classified according to age and inch of height, are presented in tabular form. The standard errors of these averages and the standard deviations around the mean are given for each height-age class. The facts are based on 21,409 issues, both Standard and Substandard in the Metropolitan Life Insurance Company, during the years 1922-1933. The statistics are given

both for the combined sample of Standard and Substandard cases and for the Standard cases alone. The range of heights was from 6′ 2″ to 7′ 1″.

2. Both mean and median weights increased with age and with height, but at the later ages and the taller heights these increases were small or disappeared altogether.

3. The standard deviations of the weights likewise increased with age and with height, but the increases were small or non-existent at the older ages and the tallest heights.

4. The diminishing rate of increase of weight with height and with age in these statistical averages and in the standard deviations may be evidence of a greater conformity to a common build type—in this instance, the linear type—than is found among men of shorter heights.

5. The median weights of these tall men were usually from 2 to 3 pounds less than the mean weights. We believe that the median weights are superior to the averages as norms.

6. The average weights of very tall men in the present study were compared with those in earlier tables from insurance and other sources. Our average weights were found to be lower than those in the earlier insurance studies and than those that appear in the commonly used height-weight tables. This is especially true at the older ages.

7. In the aggregate, the mortality of these very tall men was satisfactory. Our experience on Standard cases, which is based upon a total exposure of 71,292 years of life and 280 deaths, gave a normal mortality, namely, 100.3 per cent. of the expected by the Basic Mortality Table, 1920-1934. The Substandard group, which is very heterogeneous and includes the rateable underweights and overweights, had a mortality 147.2 per cent. of the table, based upon 159 deaths in an exposure of 29,334 years of life.

8. As in the case of earlier studies of moderately tall men, the mortality among the Standard cases was somewhat higher for the younger ages at issue than for the older ones. For all heights combined, the experience on issues at ages 40 and over was very satisfactory. Among the Substandard risks, unlike the Standard,

there was no consistent trend in the mortality ratios by age at issue. This reflects the heterogeneous nature of the Substandard group and was largely due to the unfavorable mortality on overweights in the middle ages at issue, between 30 and 50.

9. When studied in detail according to height, the mortality of cases accepted for Standard was entirely satisfactory for heights 6′ 2″ and 6′ 3″. At 6′ 4″ the mortality was unsatisfactory, 141.1 per cent. of the expected, and at 6′ 5″ and over, a small group, the mortality was also relatively high, 123.3 per cent. of the expected. The amount of experience on these taller cases, however, was not large enough to warrant any serious concern regarding them. Moreover, among Substandard cases, the mortality at these tallest heights was little higher than for the Substandard group as a whole or than for Substandard risks 6′ 2″ in height.

10. When studied according to weight groups, these tall men showed normal trends. The death rates tended to be high for underweights, slightly so in the Standard group but markedly in the Substandard group, and this was not confined to the youngest ages at issue. The experience was most favorable for those who were average weight or within 30 pounds above or below average. The mortality was definitely high for overweights.

11. The causes of death also followed the normal pattern. The mortality from tuberculosis, which evidently is one of the important presumptive risks among tall men according to insurance underwriting practice, was found to be low. Influenza and pneumonia, on the other hand, tended to cause above-average mortality among underweights, but not to the extent that might be viewed as serious. The mortality from degenerative diseases was high only among overweights, a condition which is also common among overweight men of shorter heights. The mortality from diabetes was normal in the aggregate and in its distribution by weight and height groups.

This study of our experience on exceptionally tall men has given us important new information regarding their build and mortality. Little more need be said regarding the anthropometric

side of the study. Our data indicate need for slight revision of weight standards at very tall heights. Our finding that these tall men show a general tendency to conform to a common build type will be useful to anthropologists. Of particular interest to the insurance physician is our mortality experience on these tall men. This experience, moreover, is timely because it is likely that the number of such cases is increasing and, consequently, more of them will come up for consideration as insurance risks. Despite the fact that the Medical Impairment Study showed a slight decrease in the average height of men, as compared with the earlier Medico-Actuarial Investigation, there is a body of authentic data to show that the average height of our population is increasing.

In general, our mortality experience on very tall men has been satisfactory. Before discussing the meaning of this result, it is well to consider whether the care exercised in the selection of these tall men is an important factor. It is true that we have been very cautious in accepting these cases because we were somewhat skeptical about their insurability. Consequently, we have been inclined to insist on a relatively high standard of physical condition in these men. We have probably rated them more frequently than other applicants in the presence of relatively slight abnormalities, found on examination, or in the presence of slightly adverse medical histories which otherwise would usually be ignored. In the same way, we have not hesitated to reject very tall men for conditions which, in men of shorter height, would result only in an increased rating. To what extent this excessive caution has affected the results, it is impossible to say. Undoubtedly, it has had some effect. But, in our judgment, it is not the major factor in our relatively favorable results. This judgment is based on the fact that the presumptive reasons for our caution in accepting these cases have not been confirmed.

Let us consider, first, the hazards arising from respiratory diseases. So far as tuberculosis is concerned, it is not a problem in this experience. It may have been important a generation ago, but the situation has changed so rapidly for the better in regard to tuberculosis, that this disease can be pretty much discounted as a special risk in these tall men. We are justified in this statement

because we have a fair-sized experience on very tall underweights. Other respiratory diseases do show a higher mortality among the tall men, but the excess is not serious and, moreover, is generally found, to at least as great a degree, among men of shorter heights who are either underweight or seriously overweight.

Another hazard about which we may have been somewhat apprehensive, in more recent times, is that excessive height may, in a significant proportion of the cases, reflect pituitary disturbance. We have no definite proof that this supposition is unwarranted, but it appears unlikely. One evidence of this is the fact that there were only five deaths from diabetes, which is often a complication of pituitary disease, and which might, therefore, be expected to cause a high mortality if pituitary disorder were a factor in the excessive height of these men. Moreover, all the deaths from diabetes occurred among older men, four of whom were definitely overweight and every one of the deaths was recorded in the group 6′ 2″, the shortest height considered in this study. It is true, of course, that men who showed obvious signs of pituitary disturbance would not have been accepted for insurance and, therefore, would not be represented in this experience. But it is quite unlikely that, in the ordinary routine of insurance examination, all early cases would be recognized.

From the careful and detailed analysis of our experience, therefore, we believe that exceptionally tall men, within the range included in this study, are definitely insurable risks. Most of them are acceptable for Standard insurance. Little more care is needed in their selection than in the selection of moderately tall men. The excessive caution that has been practiced in the past is largely unwarranted. Up to 6′ 3″ certainly, and perhaps two or three inches above that height, the great majority of these cases are physically normal persons. They merely represent the upper limit of height distribution. The cause of their excessive height is likely to be pathologic only in a few instances. At the tallest heights, some circumspection is necessary and we are justified in looking for pathologic signs. Exceptional cases may call for the expert opinion of an endocrinologist, and in these few cases we

should extend ourselves in order to be fair with the applicant before we reject him.

REFERENCES

1. Clark, C. P., Proceedings of Association of Life Insurance Medical Directors of America, Vol. 23, page 46, 1936.
2. Gould, G. M. and Pyle, W. L., Anomalies and Curiosities of Medicine, W. B. Saunders Company, Philadelphia, 1897.
3. Experience of Thirty Four Life Companies Upon Ninety Eight Special Classes of Risks (Specialized Mortality Investigation), Actuarial Society of America, New York, 1903.
4. Supplement to Medical Impairment Study, Actuarial Society of America and Association of Life Insurance Medical Directors, New York, 1932, page 30.
5. Medico-Actuarial Mortality Investigation, Association of Life Insurance Medical Directors and Actuarial Society of America, Vol. 2, New York, 1913, page 22.
6. Standard Mortality Ratios Incident to Variations in Height and Weight Among Men, Joint Committee of Actuarial Society of America and Association of Life Insurance Medical Directors, New York, 1918, pages 14-15.
7. Medico-Actuarial Mortality Investigation, Association of Life Insurance Medical Directors and Actuarial Society of America, Vol. 1, New York, 1912. (a) Crude average weights, page 36 and raw data for height 6 feet 5 inches, page 34. (b) Graded average weights, pages 37-38.
8. Diehl, H. S., Human Biology, Vol. 5, page 445, September, 1933.
9. Medical Impairment Study, 1929, Actuarial Society of America and Association of Life Insurance Medical Directors, New York, 1931, pages 144-145.
10. Shepherd, G. R., Proceedings of Association of Life Insurance Medical Directors, 1912, page 46 (Read at the 17th annual meeting in 1906).
11. Committee on Heights and Weights, Medical Section of National Fraternal Congress, Proceedings of National Fraternal Congress, 1900, page 139.
12. Bohlman, G., Mortality of German Overweights and Underweights, September 18, 1911, (Manuscript of translation of report).
13. Orr, L. P., Transactions of Faculty of Actuaries, Vol. 8, page 103, (Read at the annual meeting in 1919).
14. Tyler, V. W., Journal of Institute of Actuaries, Vol. 54, page 216, 1923, (letter of A. Levine).
15. Love, A. G., Physical Measurements, Army Medical Bulletin, No. 28, Carlisle Barracks, Pennsylvania, 1932, page 40.
16. Weeks, R. W., Transactions of Actuarial Society of America, Vol. 8, page 17, 1904.
17. Knight, A. S., Proceedings of Association of Life Insurance Medical Directors, Vol. 9, page 193, 1922.

DR. RUSSELL—I am afraid I have a rather disappointing announcement to make. Dr. Charles B. Davenport, who was to

address us at this time, has been forbidden by his physician to make the trip to New York. However, in order not to disappoint us entirely, he has sent us his manuscript to be read at this meeting. As Director of the Laboratory of Experimental Evolution at Cold Spring Harbor, Dr. Davenport has not only been a prolific contributor to the literature on various biological subjects but has also established himself as one of the foremost authorities on biological research. For a number of years he was Director of the Department of Genetics, Carnegie Institute, Washington, D. C.

I know that, while we are all disappointed in not meeting Dr. Davenport in person, you will be pleased to learn that Dr. Robert M. Daley, who you all know has the soothing voice of a radio announcer, has kindly consented to read the paper.

Dr. Daley—(Reads the following discussion by Dr. Charles B. Davenport, Carnegie Institute of Washington, Cold Spring Harbor, N. Y.

The examination of our recruits to the World War Army offered the opportunity to compare the stature of recruits found affected with specific defects and diseases. I may summarize some of the findings.

The most striking of these defects and diseases associated with tallness are, in order of importance: varicose veins, varicocele, pulmonary tuberculosis, goitre (both exophthalmic and simple), mitral insufficiency, hemorrhoids, simple tachycardia, mitral stenosis and valvular disease of the heart. Men with pulmonary tuberculosis were, on the average, about 0.6 of an inch taller than the mean of the recruits.

Costano (1936, p. 46), working at Boldrini's laboratory, found that Italians dying before fifty-two years of age had an average stature, 0.61 cm. less than that of Italians dying after fifty-two years, but this difference is not significant since the probable error of the mean is 0.49 cm. Again, the mean stature of persons dying between twenty and twenty-four years was taller than that of those dying at sixty years and over, but the difference was not statistically significant. The slight excess may well have been due to the excessive stature of persons with pulmonary tuberculosis who tend

to die young. The tallest group included those who died at between fifty-two and fifty-nine years, but the differences are not significant.

I have had the statures and age at death of 1,075 persons taken off from the Family Records at the Eugenics Record Office. These were divided into four lots: males who died under fifty-two years of age; males who died at fifty-two years or over; females who died under fifty-two years of age; and females who died at fifty-two years or over.

The correlation r was calculated between age at death and stature. The correlations found are as follows:

For 174 men, aged under fifty-two years,	-0.030 ∓ 0.090
For 223 women, aged under fifty-two years,	$+0.129 \mp 0.065$
For 399 men, aged fifty-two or over,	-0.032 ∓ 0.053
For 279 women, aged fifty-two or over,	-0.076 ∓ 0.059

None of the correlation values are statistically significant, since in no case is the correlation twice the standard error, $\frac{1-r^2}{\sqrt{N}}$. The nearest approach to significance is found in the younger women in which the taller tend, perhaps, to live slightly the longer, or possibly because they lived longer they were taller; i. e., there were twenty females in our study who died under twenty-two years of age and some growth in stature is possible between seventeen and twenty-two years.

There are certain refinements that might be carried out. Thus the material might be divided by race and into smaller age divisions. But it is probable that the result would still be that stature within the normal limits is not correlated with longevity. In this respect it differs strikingly from body build.

Dr. Russell—I think that one of the most fascinating specialties in all the realm of medicine is the study of endocrine glands. You will recall that, last year, Dr. Lahey of Boston was kind enough to show us a moving-picture film depicting some of the various diseases affecting these glands. Today, we are to have the pleasure of listening to the first President of the Association for Research in Nervous and Mental Diseases, and one of the best known endocrinologists in America. I am very pleased to present at this time Dr. Walter Timme, Professor of Clinical Neurology at Columbia

University, who, I feel, will give us some real information regarding the role of the endocrine glands in controlling stature.

Dr. Timme—I appreciate distinctly the honor and pleasure that you have given me by asking me to address you on a subject which, in itself, is exceedingly interesting and which, I believe, sheds a great deal of light on many problems that heretofore have been, to a certain extent, comparatively inexplicable.

Dr. Dublin's paper, which I was fortunate enough to receive and which I read carefully, was extremely interesting and represented a tremendous amount of work. The conclusions drawn therefrom cannot be covered in the limited time allotted to this paper. Many of the conclusions are extremely interesting because, from the statistical point of view, they fit into a clinical conception of the tall man; notably, the curious situation arising from the statistical reports that in the third decade of life more of these patients, or clients, die than in the fourth decade of life. This is exceedingly interesting. Later on, I think I can show you why that is so.

There is another point I should like to make and that is that, from the statistical standpoint, it would be highly interesting to determine what becomes of those risks that have not been accepted and have died; that would shed a great deal of light on the mortality and viability of those that have been insured.

In the field of Endocrinology we see many of these cases, and I think the very best method of explaining their difficulties in maintaining themselves in a highly diversified world is to point out how their condition originated. This, perhaps, will shed some light on the particular problems that have been advanced.

In the first place, we can dismiss without any further discussion that person who is simply large proportionately, whether he be six feet two, six feet three, or six feet four. If all his organs, and his build, and his stature, and his heart, and his lungs show no defect and are proportionately built, he is a good risk. That is to say, he is as good a risk as a person who is five feet high with normal and proportionately-developed stature and organs. But there are very few such, comparatively speaking. These we are going to

leave by the wayside. Of interest to us are the ones that show difficulty in their existence.

Now the tall man, and the tall woman for that matter, begins life not as a normal individual. In other words, the element of tallness does not exist at birth, but the underlying principle of that tallness exists at birth and it is important to know what that is.

These patients have a group of constitutional presentations that are different from the normal. In the first place, certain of their organs are too large and others too small. The organs that are large are the thymus gland, and the liver, and the spleen, and lymph patches in the intestine, etc.,—the so-called lymphoid organs. Because that largeness made the first impression on examiners, they called the picture presented by these patients *status thymico-lymphaticus.*

We know at the present day that the large organs are neither the important nor the sensational ones; but the basis of that structure lies in the deficient organs that these patients show; namely, those that belong to the cardiovascular system. An extremely small heart and an aorta at maturity not larger than your little finger fit into this picture. In the endocrine system there is usually a small pituitary fossa, a small adrenal group, a small thyroid and small genitalia.

Because of the smallness of the important organs I have just mentioned, the term has been changed from *status thymico-lymphaticus* to *status hypoplasticus,* accenting the deficiencies which are the important criteria.

Now, how do these deficiencies affect our patient? In the first place, the small cardiovascular system means that the patient had difficulty in doing all the feats that require the energy that his more fortunate colleague has. This is to say, he has a low blood pressure; he cannot call upon his cardiovascular system for undue exertion. This element alone immediately makes of this human being one that is somewhat inferior, although there is no disease picture presented; simply a constitutional inferiority.

When we come to discuss the glandular elements, which I shall do now, you will see further deficiencies arise in that constitutional disturbance. In the first place, the largeness of the thymus gland

in youth produces rapid growth. Years ago the truth of that statement was contested, but experience in the meantime has shown us that the thymus gland has in it a tremendous factor of growth, probably equal to that of the anterior lobe of the pituitary gland—if not greater. That is borne out by Rowntree's recent experiments with his rats, showing that, when fed by a thymus extract, these rats developed and grew to a tremendous extent as compared to the normals, especially when these injections were carried on in successive generations. In our experimental work with boys and girls of excessively rapid growth, it has been found that X-ray treatment of the thymic region tends to flatten the growth curve. We have no doubt at all that the thymus gland has a growth factor in it which is important. Patients having large thymuses are therefore subjected to the influences of this growth factor. As a result, they grow rapidly but they do not grow proportionately; hence, the thorax is too long for the legs, or the legs are too long for the thorax. As the various units of the skeleton are not firmly bound together, their arms are like flails; they can dislocate the jaw, or the fingers, or the hips. The ligaments of the arch of the foot produce in time, and not a very long time, a flat foot; because the ligaments of the sacro-iliac joint are not firm, motion which subjects the back to strain produces backache. So again we have a constitutional cause of disturbance in these patients, apart from any of their problems. They cannot energize, they cannot, without undue fatigue, do what their confreres do. In addition, they have flat feet and they have backache.

Now let us look at the implications that are presented, put into the picture of the internal glandular elements such as the pituitary; the pituitary, curious as it may seem, is not overactive; it is underactive, markedly so, and because of that, the blood pressure is low and the blood-sugar is low. That lowered blood-sugar is an added factor to the fatigability, because sugar in the blood stream is an absolute necessity to muscular activity, and if it is not there the muscles cannot utilize it and muscular fatigue ensues.

Because of the low activity of the adrenal and the smallness of the adrenals, again the blood-sugar is low because the adrenals have effect on the blood-sugar; and the blood pressure remains

low. The coagulation time of the blood is long because the known effect of pituitary and the adrenals is to produce a normal blood coagulation time. With these deficiencies the blood coagulation time is increased to ten, twelve, fifteen minutes and the fact of importance that goes with this long coagulation time is lowered resistance and lack of ability to fight. Those of us who are familiar with Cannon's work realize that fight, fear, running away from dangerous situations, are all connected with long coagulation time of the blood, which, secondarily, is affected by deficient adrenal glands.

This long coagulation time of the blood has something to do with our patient's symptoms in the course of his progress. Because of the inadequacy of the cardiovascular system, the thinness of the blood vessel walls and the long coagulation time, there is, on slight provocation, a ready flow of serum and plasma of the blood through these thin walls into the surrounding tissues. Hence, these patients have purpuric spots, purpura haemorrhagica. They have the large masses of urticaria occasionally accompanying these deficient states. They have the exudation of serum into some of the important structures, such as the bronchial tubes, and with the tension in the tubes and this exudate they are subject to asthma and all the chest diseases that accompany asthma. They are subject to a large extent to the allergic disturbances with this long coagulation of blood and deficient adrenals. We can, therefore, see what an enormous medical picture can be made of the deficiencies of one constitutional group with no disease whatever.

The gonads are deficient. They take a long time to develop. The pubic hair takes a long time to grow. The mustache and beard come in very late. The secondary sex characteristics as a rule, therefore, are delayed. They are held in abeyance. The human being remains childlike, therefore, long beyond the point where he should have been mature.

In the beginning of life, because of the smallness of the blood vessels and the tendency to bleed and the large thymus, there is a very large incidence of death on slight provocation, or on almost no provocation, the so-called thymic death. There is hemorrhage

from the thin-walled blood vessels into the suprarenal cortex or into the ventricles of the brain or from the coronaries, any one of which has an immediate lethal termination.

Now, how do these patients ever survive with all these inadequacies? Well, if we realize that the major inadequacies are a lowered blood pressure, a low blood-sugar, particularly a growth disproportion,—if any particular tissue of the body could be made to compensate for these inadequacies so that there would be an increased blood-sugar, an increased blood pressure, a lack of permeability of the vessel walls, then we would have in such a patient a mechanism which would tend to cure. Well, we have such a mechanism. That mechanism consists largely of the combination of an adrenal and a pituitary overactivity. We cannot prove an overactivity of the adrenals, but, from several standpoints, we can prove an overactivity of the pituitary. In the first place, this pituitary gland, as you know, is situated in a very small cavity at the base of the brain, an actual skull—an actual skull within the regular skull that we all are assumed to have. It is protected probably better than any other tissue in the body. It is surrounded by the circle of Willis, which is one of the most marvelous blood vessel anastomoses in the body; it prevents a lack of blood at any time being produced within the pituitary cavity. The blood vessels are supplied numerously from all sides of this circle of Willis, so anemia of the pituitary is hardly conceivable.

If that pituitary gland could take upon itself some automaticity in regulating what these patients have only in diminished quantity, then we would see a way out of their difficulty. Well, the pituitary does just that. It begins to enlarge, and as it begins to enlarge, the patients, some of those that have small sellae turcicae to begin with, feel this enlargement. This enlargement produces pressure not only within the sella turcica but upon the diaphragm of the sella, which is stretched. This feeling is transmitted to them as a headache and they describe that headache as a headache midway between the temples or down from the vertex or back from the nose. All of those lines radiate to the sella turcica.

Those headaches come on whenever those patients attempt some physical exertion beyond their power, thus producing fatigability.

If they go too long without food, a few hours beyond their ordinary lunchtime, they get that headache. If they walk too far, too strenuously, they get that headache. If they are chagrined or very depressed over long periods of time, two or three days, they get that headache. Overindulgence in sexual intercourse produces that headache and it is always in that same region.

When those headaches persist, as they do, for a decade or two and we then examine their skulls through X-ray, we find very interesting stigmata that indicate that that patient has had these headaches. The sella turcica shows erosions; it shows thinning out of the walls. It shows, sometimes, such eburnation of the anterior and posterior clinoids that they become absolutely absent. Occasionally, the pituitary forces its way through the posterior clinoids, causing an actual fracture.

As the years go by this cavity, which was originally small, becomes larger and larger, until it reaches that point at which it can accommodate the pituitary through all its emergency enlargements, and then the headaches spontaneously cease.

Now the history of headaches, when followed through many families, will give that complete history of having begun about the time of puberty and having gone through two or three decades and then, finally, whether we did anything for it or we did not do anything for it, the headaches gradually ceased. When we examine the skulls of those patients, we invariably find the cause of the headaches and why they ceased.

With that enlargement of the pituitary, we get an increase in the blood-sugar, we get an increase in growth, we get an increase in blood pressure, we have less and less permeability of the blood vessel walls. The blood picture changes, the coagulation time becomes shorter and gradually the vessels and the heart become larger. There is an interesting fact, which I will tell you as an aside, that the pituitary produces an enlargement of every organ in the body, excepting the thymus gland, which it causes to decrease in size. So, as this pituitary becomes overactive in the second period of life of these patients, the second decade, the thymus disappears, pituitary growth increases, all the constitutional abnormalities which that patient has shown at that point gradually dis-

appear and then the headaches disappear and, if the compensation has been complete, these patients become absolutely normal human beings. The genitalia develop properly, the secondary sexual characteristics appear; they lose all their inadequate properties, but at the expense of growth. Because the pituitary, while it does all these things in a compensatory way, also at the same time produces the increase in growth, we have a large human being that began life wrong but corrected himself automatically by an adjustment of his internal mechanisms to become a normal human being. He arrives at that stage much later than the normal. He may not arrive at that stage before the twenty-eighth or thirtieth year or perhaps later, but when he does arrive, he is just as good as anyone else, perhaps better, because he remained a child much longer and had a great many more varied experiences before he became an adult. Some of the best people we have in our community belong to that particular group.

Now, between those patients that die in infancy because of enlarged thymus and those that arrive at normality in the third or fourth decade, there are innumerable cases that do not die and that do not arrive at normality. They keep bothering along in their twenties and thirties, all with some inadequacy or other; either it is an orthopedic inadequacy or a cardiac inadequacy, but it is always an inadequacy that has to do with fatigability. Those are the ones that do not go to cure; those are the ones Dr. Dublin showed in his statistical analysis; those are the patients that have a larger mortality rate in their third decade than those that arrive at complete maturity in the fourth decade; those are the ones that have not entirely compensated, whereas the fourth decade ones have entirely compensated. That is what makes their mortality rate greater in the earlier years.

These patients that do not fully compensate are the ones that are our problem. Those are the ones we used to call neurasthenic, psychasthenic. Every decade we invent two or three new names to cover their situation. They almost invariably belong to that group that began life as a status hypoplasticus case and did not compensate. If they do not compensate as to their stature and as

to their joints, then they go to the orthopedist. If they do not compensate as to their cardiac condition, then they go to the cardiologist, and so on. Sometimes they do not compensate as to their psyche. They are mentally inadequate and every one of these various components of developments are subject in them to some disturbance. It is the normal human being that arrives synchronously in all these elements of development; and the abnormal one is he who does not arrive synchronously in these developmental factors.

Therefore, we see that these large people in this group are not, in their beginning, pituitary; they are thymic. A decade or so ago, we used to call them thymic giants. Many of them that die and go to autopsy show certain criteria, certain stigmata of this status hypoplasticus. They all have the small genitalia. Many of them have remains of the thymus gland, even in the second and third decade. All of them have very small adrenals.

The pituitary is subject to change because of its compensatory and enlarging effect later on in life, so some have small pituitaries and some large. Practically all of them show these disturbances until an adequate compensatory mechanism makes them normal.

In looking over insurance statistics, we invariably find the components that make for the insurability or non-insurability of the applicant to be height and weight correlation. I do not think that is right. In a very good clinical way it helps to group the normal and the abnormal. But far back of weight and height there are factors of which weight and height are only the terminal possibilities. They are not the beginnings, they are not the origins of the disturbances for which you reject applicants. The origins are in the glandular system; in the cardiovascular system which is a factor of the glandular system, perhaps; in the mineral constituents and in the vitamin possibilities of these patients. Far back in early life, we will find those incidents that later on make for a disturbance in height, or a disturbance in weight, or a disturbance in the correlation between the two.

I am going to show you on the screen a few of these growth cases that are in that realm between six feet two and six feet six. I am going to show their growth, I am going to show their stature,

their pituitary glands, the size of their pituitary fossae and explain to you their present status and how they arrived thereat.

(No. 1 slide) Here is a young man. He is between six feet two and six feet, three inches in height. He looks the picture of health and of normal development. Well, he was sent to us during the War because he slept at post and was court-martialed for it. When we examined him, we found that he had a large thymus, a minute heart—a ptotic heart. He still had his feminine pubic hair. He had a low blood-sugar and exceedingly low blood pressure. His pituitary gland was so small that it could not have been effective for a person of his stature by fifty to seventy-five per cent. The reason for his sleeping and his fatigability was this low blood-sugar and a low blood pressure, particularly, and an inadequate cardiovascular system.

We began feeding him pituitary and that helped him tremendously. Then came along a post surgeon who thought Uncle Sam was paying too much money for pituitary extract and, therefore, stopped its administration. The effect was so disastrous that, before very long, it was again used with great advantage to the patient.

(No. 2 slide) Now here is his pituitary fossa. There is the skull, the brain cavity, and the brain cavity rests on that shelf of bone and approximately in the middle of the shelf of bone is this structure. At any rate, you notice that this pituitary fossa is entirely enclosed by enormous clinoids, anterior and posterior, leaving a minute cavity for the pituitary. Ordinarily, if you looked at the boy, you would say that his pituitary is not normal but hyperactive; on the contrary, it was small and decidedly underactive.

(No. 3 slide) There is a young man six feet four, or five, in height. He looks like a prize fighter, almost, but he was not. He was sent to us for the same reason the other young man was sent—he slept at post. I said he could not have kept awake if a bayonet had been at his breast. He simply could not do it. He was utterly fatigued by an hour or so at post and he succumbed to it. Now he showed many of the stigmata of the other boy. He had no mustache, no beard. His pubic hair was horizontal. He was

twenty-three or twenty-four years of age. He had no axillary hair. He had low blood pressure and low blood-sugar and we recognized the case immediately for what it was.

Then I sent him to military class without previously questioning him. That is a very bad technic. You have to know just what answers your patients are going to give you before you show them to a class. I did not with him. I said I wanted to show how effeminate he was in spite of his build. He had gone to college. I asked him, "What did you do at college? What games did you play"?

He said he played football. That knocked my theory in the head. I hazarded another question and I asked, "Did you play often"?

He said, "No. I only played in one game and I was knocked out in the first half and didn't go back again".

That saved me. That is his type. Now the interesting thing is this: After he left college, he became a stenographer and typewriter. That is interesting, because that is exactly the group in which he fitted, in spite of his stature. After we have fed him pituitary substance for a certain number of months, I will show you the change in him.

(No. 4 slide) Now the first thing that you notice is the hair has become pyramidal and down here there is a good deal of hair on the thighs. He does not look as pudgy as he did and he has an entirely different face. It is an aggressive face, it is not of the recessive type, the shy type, but is actually aggressive. In order to show that difference much better, I have both pictures on one slide.

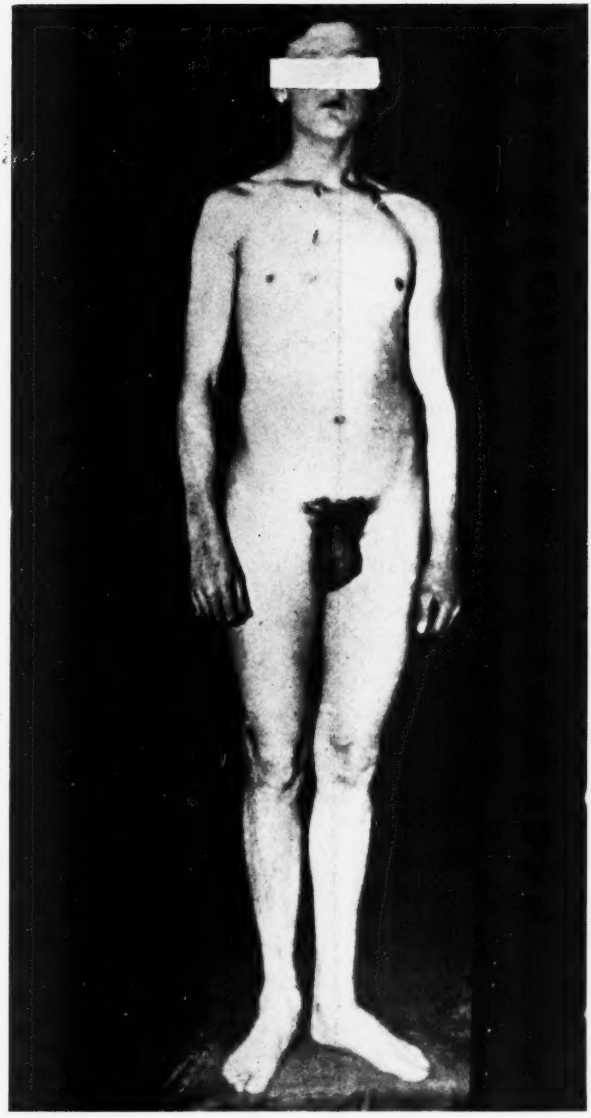
(No. 5 slide) There is his orginial picture and there he is after treatment. You see the difference in the individual. If we had let him go four or five years without treatment he possibly would have arrived finally as a perfectly normal human being six feet, four inches in height, but we hurried him along by doing what we thought his natural internal mechanism would do. That is exactly what happens to human beings that compensate for their inadequacies.

(No. 6 slide) Here is a case, six feet, five inches high. He was, when that picture was taken, probably 27 years of age. He came to the Neurological Institute in 1917 and 1918 because of fatigue and pain. He had pain in his head, and then he had pain in his back, and he had pain in his foot and he could not work for a day or two at a time, and so forth and so on. Well, he was put down as a neurasthenic, because he did not always have the pain in the same place; it varied. He had a pain in his heart today and a pain in his foot tomorrow and that went under the "neurasthenia" diagnosis. He was put down for observation. Suddenly we noticed that his legs began to grow, and his feet began to grow, and his hands began to grow. As far as we knew, those were never symptoms of neurasthenia. There must be something else wrong with that young man. Then we thought probably his pituitary was large. We took a picture of that, and found it very small. He had a thymus and that is why he grew. We did not feed him anything. We watched him. We gave him placebos. He thought he was getting medication. We did not understand the situation and we let him go for years until he finally got well.

Now he looks like that today. He has a little more hair, but he is adequate. He works, he has a wife and family of three or four children. He works in a factory at a lathe, works his week out, gets his pay, has practically no complaints at all, and we never did anything for him but watch him; but he did it for himself. He is one of the cases in which this automatic mechanism brought him out of the slough in which he was and made a normal human being out of him at the age of thirty-five or thirty-six. We learned through him what was going on within him. His was a classical case of such a disturbance.

Here let me interpolate this. If he stripped before you, you could not say that he was an endocrine adequacy case today by looking at him. You know all the story books you read and Sunday magazines and various other lay publications that tell you about the way a man looks, or a woman looks, who has an endocrine disturbance. You have got to accept them with a grain of salt. No man ever looked worse than this case does, yet he is normal actually in his ability. He never recovered his shape or his stature

SLIDE 1



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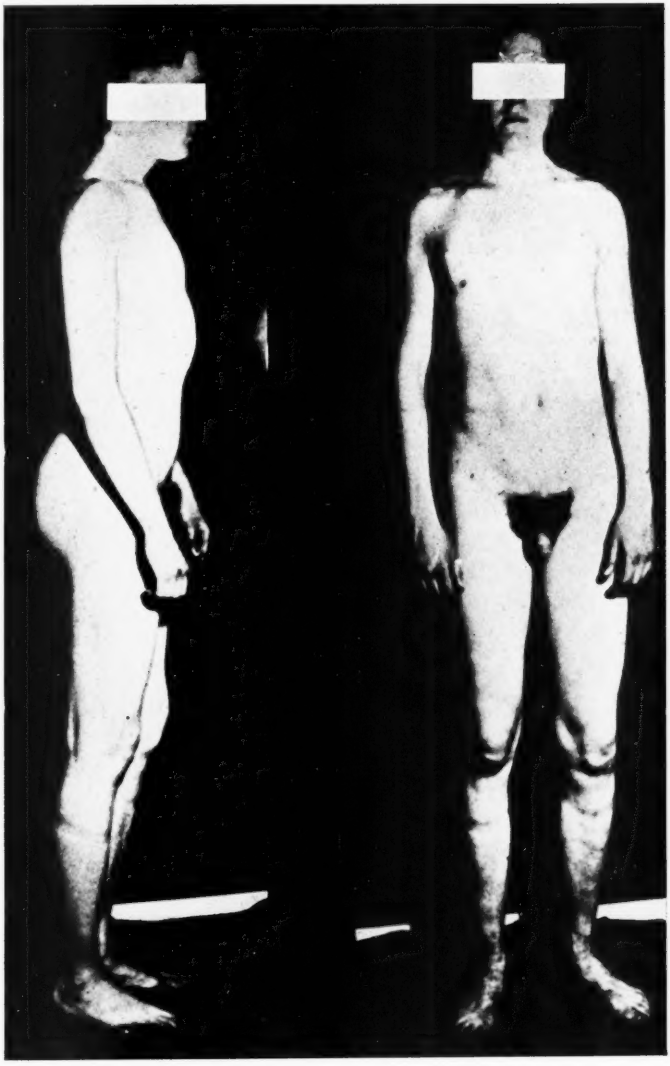
SLIDE 2

SLIDE 3



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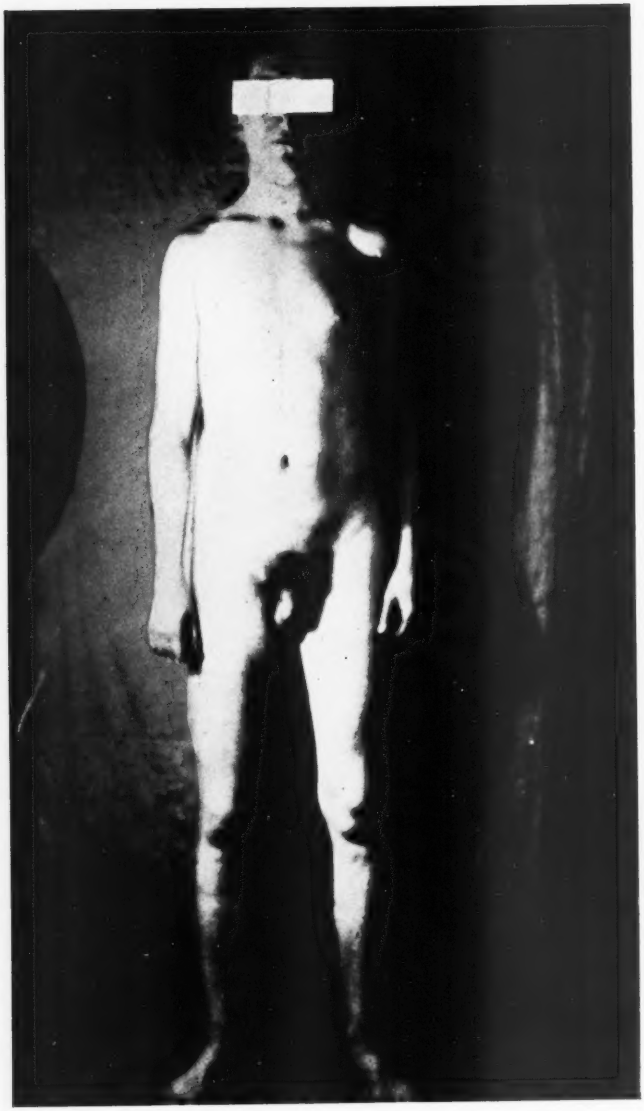

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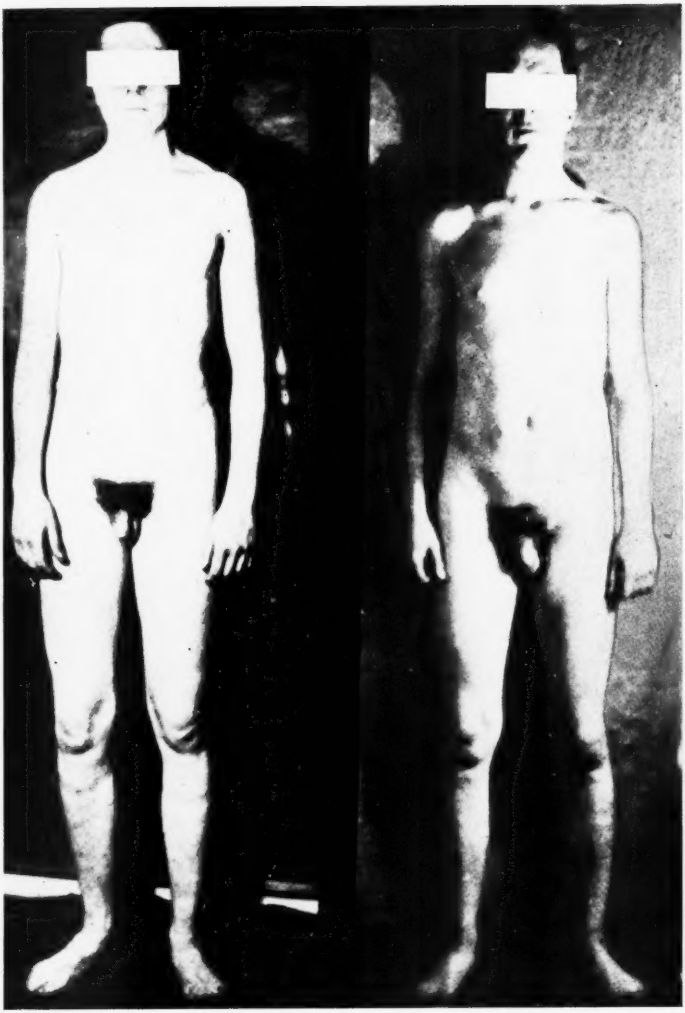

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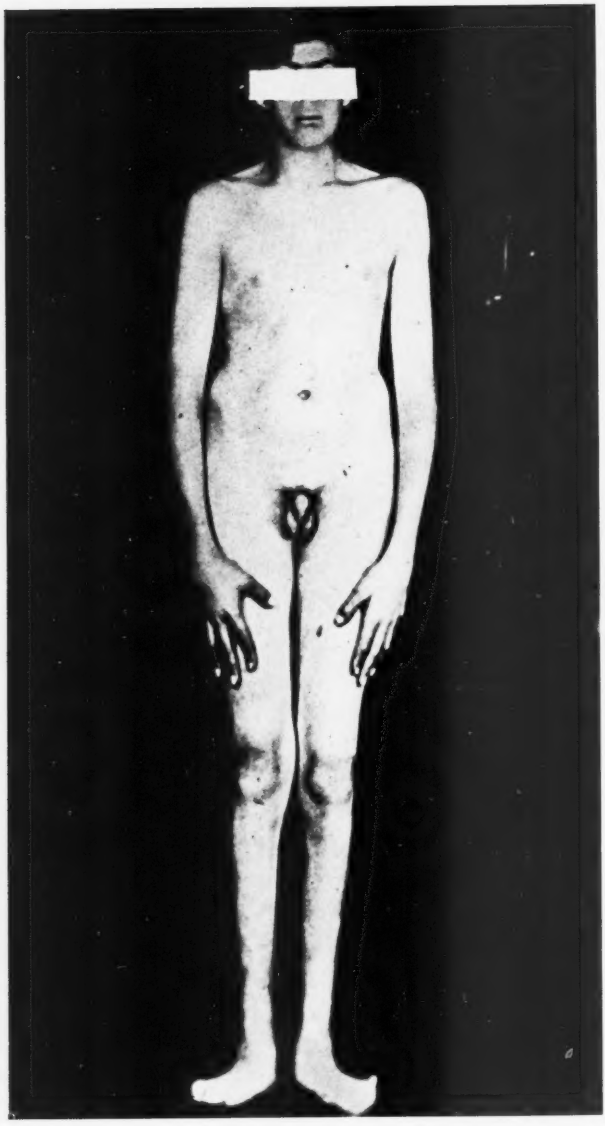
SLIDE 6

SLIDE 7

SLIDE 8



properly. In other words, the exterior does not necessarily connote an interior disturbance; it does connote a past interior disturbance but not necessarily a present one—and that is exceedingly important.

Notice the short thorax as compared with his tremendous length of leg. That is one of the so-called hypoplastic characteristics. Another hypoplastic characteristic, which you do not see here, is a reversive scrotal fold. These patients have scrotal folds that cover the base of the penis like the labia. That is one characteristic that, no matter how well they get, they never lose throughout life. You can very often determine whether a patient was an original hypoplastic by seeing this fold of skin surrounding the base of the penis like the labia in the female. There are several stigmata of the hypoplastic group. Another is that while the upper maxillary bones as they come together in the median line ought to unite without any furrow or elevation at all, yet these cases have a fibrocartilaginous elevation in the middle of the roof of the mouth, which is sometimes as large as a walnut. I have had patients, and physicians bring patients to me, because they thought it marked a beginning sarcoma. It had been there all the patient's life and the patient never knew it.

I want to show you how we understood, or thought we understood, the spontaneous arrival at normality in this patient. He complained of headaches, unilateral headaches. That was the key to the situation. We therefore X-rayed his skull.

(No. 7 slide) Here is his sella turcica. If you look at that sella turcica, you see that the original sella had probably this shape right here. There is a line of demarcation at the posterior clinoid at one point and then the other clinoid on the other side posteriorly goes up to this point. In other words, there has been a unilateral eburnation of his pituitary fossa and that was on the side of the headache. That is to say, the gland enlarging pressed to one side and eburnated the one side of the pituitary, making room for itself. The headaches disappeared. He made room for his own pituitary. The pituitary enlarged sufficiently to accomplish all it had to accomplish, and he is practically well. We realized then that he

was made well by his own unaided automatic or autonomic mechanisms. He is six feet, five inches high and he, today, would be an absolutely normal risk.

(No. 8 slide) Here is another type. I show you this boy, this young man, because of the fact that he shows the abnormality also of the enormously long leg and the short thorax. He also shows the small genitalia, although he is 26 or 27 years of age. He is beginning to get better; we know it through his headaches, which you may now know are not a disease process. Those headaches accompanied by growth and an increased blood pressure are purposeful headaches. They are a sign manual that the human being is arriving, or tending to arrive, at a normal level, partly through efforts of his pituitary, thus causing the headache. Those headaches, therefore, are not disease processes at all but compensatory ones. That must be understood.

Now, then, we see that when we look at the problem of growth and realize the numberless factors that go to make up such a tall individual, how interesting the whole study becomes. You say, for instance, the correlation between this man's height and his weight means that he is not a proper risk; however, he may be a proper risk if you go far back and study the origins of these correlatives. You will find causes for all of them and if properly treated, a risk that is not insurable at a comparatively early age can be made insurable by proper treatment or by adopting a Fabian policy, to see whether the young man is not automatically bringing himself to a point where some day he may be an insurable risk. The tall man, therefore, must be studied as to the reasons for his height before being declined as non-insurable.

Well, now, if I have in any degree made the problem of height, abnormal height, clear or clearer than it was, I shall consider my time well spent.

I thank you very much indeed!

Dr. Russell—I believe that Dr. Clark, who is very familiar with the subject, would like to make a few remarks. Before he does, I want to thank Dr. Timme. I am very sure that we all

enjoyed his talk and know considerably more about this type of disturbance than we did before. We should now like to hear what Dr. Clark has to say on the subject.

DR. CLARK—It seems certain that the question of the desirability of issuing standard insurance on excessively tall men has been a problem for all of us in the past. Our own inclination has been to be rather severe in the selection of such risks, but occasionally my Company has accepted especially select risks, who are more than 76 inches in height, though with considerable hesitation.

Dr. Dublin has so well analyzed the material used for this study that we should feel that he is in a position to give very definite recommendations.

I do not believe that any of us will care to issue insurance on tall men who are definitely of the giant class—so-called pituitary cases. But, as Dr. Dublin states, our real problem is to know what to do with men who are from 6 feet, 4 inches to 6 feet, 8 inches tall. In his Summary, Number 9, Dr. Dublin has stated that men with heights of 6 feet, 2 inches and 6 feet, 3 inches will give us a standard mortality. At 6 feet, 4 inches the mortality was unsatisfactory; namely, 141.1%, though at 6 feet, 5 inches and over, in only a small group, the mortality was only relatively high, about 120%. If we consider that a mortality of 130% is as high as we wish to go for standard insurance, we would assume from Dr. Dublin's study that we could safely consider men up to and including 6 feet, 3 inches in height without any question; that approval for standard insurance of men who are over 6 feet, 4 inches tall should either be refused, or selection should be quite severe. It is particularly interesting to me personally to see that this practical study of Dr. Dublin emphasizes the recommendations which I have made and which are illustrated in the final table which I presented in my paper. That study would indicate that, for young men, a height of 6 feet, 3 inches should be the limit considered favorable, but at 6 feet, 4 inches we could, at older ages, feel fairly liberal in issuing standard insurance if within weight limits of 170 to 210 pounds.

Some years ago Dr. Fisher stated that a liberal selection of overweights beyond the usual limits imposed by the Company for stand-

ard insurance can be made if we will take into consideration family inheritance; that is, provided the family has shown a tendency to longevity, with the weight peculiarity noted. I feel that, possibly, we could be more liberal in our selection of excessively tall men for certain races, and particularly certain families all of whom are tall and who have shown evidence of longevity. It is also my feeling that unless an excessively tall man, no matter what his age, has an excellent personal record and is free from impairments, in the interest of our companies, we should hesitate to issue, particularly on a standard basis.

There is every reason to believe that for each age group there is in build a zone of best mortality and the farther we deviate from this best zone, the greater will be the mortality. Insurance statistics have proved beyond a doubt that, with increasing overweight, there is an increasing mortality. The same is true certainly at younger ages with increasing underweight. We have shown in our own paper that giants have a low average lifetime, but what the actual experience among a large group of dwarfs will be we are not able to say. It is probable, however, that, as a group, their mortality would be beyond that experienced in men nearer the average height and weight.

Let me express to Dr. Dublin not only my own appreciation, but also the appreciation of our Association for his kindness in presenting this very practical paper to us.

DR. RUSSELL—Is there anyone here who would like to ask any questions or would like to continue the discussion?

MEMBER—I should like to ask Dr. Timme some of the points of differentiation between the thymus condition and the true pituitary disorder.

MEMBER—Will Dr. Dublin tell us whether he has any impressions as to the matter of benefits in these extremely tall men, if there is an extra accident hazard or any bearing on the disability question?

MEMBER—Will Dr. Timme kindly tell us something about the occurrence of diabetes in these tall youngsters?

DR. WENSTRAND—I should like to ask Dr. Timme if there ever have been any eight and one-half or nine-foot giants.

DR. ARMSTRONG—I had something in mind (it is just the opposite of what we are speaking about) about tall people. I will ask Dr. Timme to tell us something about the people who do not look tall but, on the contrary, remain somewhat shorter or mature rather early. Dr. Timme spoke about this type of individual maturing late. I have the impression that there are a good many people who apply for life insurance who belong to the class who mature because of endocrine disturbance rather early. I should like to ask as to what their ultimate mortality would be; instead of getting better, as these cases do in later life, whether they probably have a rather poorer life expectancy. It is a certain type somewhat the opposite of this. Maybe Dr. Timme can say something about it.

DR. CHRISTIERNIN—As to these men who mature late, do they keep maturing longer than the average man?

DR. DALEY—I wonder if Dr. Timme can tell us what happens to those who do not mature at the age of thirty or thirty-five.

DR. RUSSELL—Mr. Marks, have you anything you would like to say? We should be glad to hear from you on this subject.

MR. MARKS—The first thing I should like to discuss is the question as to what is the normal height. If we go back to our old Medico-Actuarial studies, we find that the average height was five feet, eight and one-half inches. If we go to our newer Medical Impairment Study, we get a height of five feet, eight inches. It looks as if the average height were decreasing. But actually, I think anyone who has gone carefully into the subject believes that this apparent decrease is false and that the average height is actually increasing. I think our concept of norms needs to be changed, but I do not know whether, today, we are in a

position to say what these norms are. Anyone who has studied children in immigrant families, for example, knows that the height of the children when they come to maturity is very likely to be greater than the height of the parents at the same age.

An interesting article in a recent number of the British Medical Journal, quoting statistics on recruits in various countries, showed a steady increase in height in all of them. I think the whole question of the normal height has to be kept in abeyance until we know more of the factors influencing height, not only the matter of inheritance, but also the important factor of nutrition. I am certain that we should not stick too closely to the norms used in the past.

So far as Dr. Davenport's paper is concerned, I think he found that there was some correlation of height with the incidence of thyroid disease. In our study, we looked very closely for that. As a matter of fact, we looked closely into anything that had any relationship to the endocrine system. All you gentlemen know that when you come to look at your mortality data from the etiological standpoint, they are not very good, and it is not surprising, therefore, that all our investigation of the endocrine side of mortality was practically negative.

Another thing that may be pointed out in regard to Dr. Davenport's discussion is that he found the average height at the older ages shorter than at the younger ages, but the difference was not significant. One thing that probably was overlooked is that there is a loss in height at the older ages so that the comparison is probably not a valid one.

Dr. Robinson—I should like to have Dr. Timme tell us very briefly about other constitutional types. He has given us a very marvelous description of one type. I think it would be valuable to us if he would enumerate the other types.

Dr. Clark—Dr. Russell, one thing occurs to me. I asked Dr. Wenstrand what they did about these tall men. He said, "We usually go back and ask the examiner if there is any evidence of endocrine disturbance". I replied, "Your examiner does not know what you mean". I wonder if Dr. Timme could give us four or

five brief questions we could put to our examiners on a special blank and have this investigated. I think Dr. Timme might give us something very practical along that line.

Dr. Russell—As there appear to be no more questions, I will ask Dr. Timme to reply. If he wishes to say anything further, it will be very much appreciated.

Dr. Timme—The first question was asked as to how we can distinguish a pituitary type of case from this particular hypoplastic type of case. A pituitary case does not necessarily grow tall. That seems paradoxical, but it is not. A pituitary individual grows in a distorted way, but not abnormally tall, for the reason that the anterior lobe of the pituitary which has a growth factor also has a genital factor, and, as the growth factor and the genital factor usually work together, the genitalia develop while the patient grows. As the genitalia develop, they tend to close the epiphyseal line of the long bones. So that as the anterior pituitary causes growth and sexual development, it, at the same time, causes a closure of the epiphyseal line and, when that is done, there is no further growth in height. Therefore, the pituitary type of case is distinct from this type of case because of the fact that it does not grow so tall as these but it grows in a distorted way, namely, broad and not long. The features become rather distorted, the nose rather flattened, the malar bones, or protuberances, rather wide apart, the teeth rather spaced, the hands and feet, fingers and toes rather broad. That is the difference between the ordinary pituitary case and these hypoplastic cases.

The next question was regarding diabetes in these thymus cases; almost never, unless with their difficulties they also have a pancreatic disturbance, which is apart from their constitutional character. It would be accidental. But diabetes, or a diabetic syndrome, does not belong to this group of hypoplastic cases at all. In fact, the blood-sugar is usually very low. That is one of their difficulties.

Now as to whether I know anything about giants over eight feet:—nothing at all, except those I have read about. I have never seen one. A great deal of doubt has been cast upon the existence of such tall men, but why there should be doubt, I do not know.

The affirmative evidence is pretty good and our negative evidence is not worth shucks. Why not accept that? I believe it to be true. I have never seen one, that is all.

The next question is rather interesting. Is there a type that instead of being tall and inadequate remains small and matures early, rather than late? Yes, there is. That is a very interesting type. That is the type to which many of the so-called child wonders belong. They have an early development of the pituitary beyond normal and they get to be exceedingly bright mentally, and because of the early enlargement of their pituitary, the thymus gland ceases, and, as that ceases its activity, the childhood life is gone. They begin to get hair at too early an age; they are very witty; they are very swift in their responses. They have not got the groundwork of intelligence and experience that the older ones have, but they mature more rapidly and are witty. They belong to the subthymic-pituitary type with some parathyroid disturbance. There is a distinct type of that kind.

What happens to the cases of this hypoplastic group that do not mature, those that do not die, but the remainder that survive? Well, they are always with us. That is what makes the world such an interesting place. Most of them turn to be antisocial because they cannot get along, they cannot work, and they do not work. If they are rich, well, we send them, maybe, to Egypt or California, and, if they are poor, we send them to a brother practitioner for consultation. But you cannot do much with them. They do not of their own accord do well. You can help them largely by feeding pituitary and may help them very much, but many of them you never get to a normal level. Many of them are psychically disturbed. They realize that they are different from others and then become shy and retiring. Many of them, or some of them, descend into the dementia praecox groups, which is interesting.

Now are there other types than this of humankind? Oh, yes. You see if there are eight glands and if those glands have, each one of them, three functions—a normal function, an overfunction and an underfunction—we would have as many types as there are factorial twenty-four. That would be many millions. There would

be millions of different types of individuals, depending upon a variation of each one of the glands and its over, under, or normal activity.

Many of these types we recognize, however. We have an adrenal type; a choleric type; a blood pressure type; and a hypopituitary type with deficient genitals, fat and deficient mentality, a hyperthyroid type, long and narrow, and a hypothyroid type, thick and fat and obese and slow-witted, and so forth and so on. Each one, each particular gland, has its prototype. The parathyroid is the most recent one to have engaged our attention with conduct disturbances. So there are innumerable types; and there is nothing more interesting than actually to study type by type and then, at our leisure in the matter of reading and understanding the groupings of types, the overlappings of one type with the other, to enable us in a way to understand reactions, reaction times, constitutional types and variability of the individual. They all conform to certain patterns, and without the patient telling us a single word, but merely stepping into the examination room gives us enough of a clue to enable us to diagnose his pattern. It is exceedingly interesting and very fascinating and it does go to the groundwork of a great many of our problems which heretofore we simply slurred over.

I would not attempt to say what effect it has on cancer growth. I will let our friend, Dr. Francis Carter Wood, tell that later on, but there is a very grave correspondence between them.

Now, then, whether any questions could appropriately be placed on blanks for the examination of applicants. I should say that would be an exceedingly interesting and, possibly, an important contribution to insurance literature and insurance matters and methods. It would require some time to get the three or four necessary questions. If there were thirty questions, we could give them now, but the smaller the number of questions, the longer time it will take to prepare them. Some day or other perhaps we will get to that point.

DR. RUSSELL—Thank you very much. We are indebted to Dr. Timme for his very interesting and important contribution to this subject.

I am sure that we are more than grateful to Dr. Dublin for bringing this subject up and allowing us to have the opportunity of hearing these other men. I should like to have Dr. Dublin, if he will, make a few remarks in closing this important subject.

DR. DUBLIN—Mr. Chairman, I am, of course, very much pleased the way this paper has turned out. I began with what I thought would be a very dull and learned discussion and it has turned out to be one of the most enlightening and one of the most stimulating discussions I have had anything to do with. Of course, it is entirely due to the contribution which Dr. Timme has made. I feel very much like a sort of St. John who has ushered in the real thing.

There are a number of points that were raised to which I should address myself. There was first the remark of Dr. Davenport. I, more than anyone, regret his absence. I spent six of the first real vacation periods of my life with that man at Cold Spring and he taught me most of what I know of scientific method. It was he who put at my disposal the material which I used for my Doctor's thesis. I have been under great obligation to him, and I want to put it in this record, so that when he reads it he may know that I have not forgotten him. He has served us and has served American science as very few have. It is a real misfortune that he is not here. I am sure I am speaking for the rest of you when I say that it is our hope that he will recover and enjoy the remaining years of his retirement.

Dr. Davenport in his discussion made a comment with regard to the taller height of those who died young. I should say in that connection that the material is rather old. It is not current; it is material he found in the older literature, and I believe that that really is the answer. In any case, it ought not to cause us to hesitate in the acceptance of these taller men because, if you will remember, the slightly increased mortality was for very young men. Certainly in our experience we are not confronted with that problem. The great majority of our applicants are men who have

passed that age, the early twenties; so that that really is not a factor.

With regard to Dr. Timme's extraordinarily stimulating and interesting contribution, I suspect that the great majority of these men, six feet two to six feet five, in our study do not belong to the pathologic group that he has described. I am more inclined to believe that the men with whom we are dealing here are normal human beings, and that only a very small fraction would show, if we knew their detailed growth history, the type of picture that appeared on the screen. We are dealing with really normal people who have always been normal, and our only reason for considering them abnormal is because of our presuppositions. It is that sort of thing that confounds us at many points. We get fixed ideas as to what is normal and then we are determined by that presupposition.

I think, as Mr. Marks said, we have got to expand our conception of the normal. Changes are going on in our community in a number of ways and the physiological changes are not the least important. Where you are dealing with a group of people whose average height is five feet eight, you have got to conceive of your normal as encompassing a rather broad range on either side of that average. That is the conception of the standard deviation. That idea must sink into our thinking more and more. We must not think that people who reach six feet have reached the limit of the normal. That is not true; that varies from race to race. It varies according to geographical location. It varies with habits. It varies with economic status. It varies with nutritional status. You have to conceive of the normal as something broader than the thing we thought of forty and fifty years ago. We are growing taller. We have to keep in our mind the possibility of a perfectly normal person who creeps up into the regions of six feet two and six feet three, and certainly, possibly as a result of this excellent selection, (although I would not overemphasize that), we are dealing here with a group of normal people. There were, of course, a few that crept in of the type that Dr. Timme described, and they probably were in the age range that he referred to. I think that was a most important contribution, Dr. Timme, to tie up our

statistical finding with your clinical knowledge. Apart from that, after we get beyond that age, we get a normal mortality. We get a normal mortality as is indicated by the distribution of the causes of death.

One of the questioners asked whether we had any evidence of increased accident, or increased disability from any cause. We know nothing about their disability experience. But on the score of accidents, I just looked up the facts. There was no increase in them. There was no increased incidence of anything, certainly not of tuberculosis, even among the younger men. If there was an increase in the degenerative diseases, it was associated with overweight, which you would expect and which you get among short and medium height at well as tall men. Overweight means degenerative disease—I mean excessive overweight.

The one interesting point, it seemed to me, was the utter absence of any indication of a larger incidence of diabetes. If this were an abnormal group, if this were a pituitary group, and if this were a group with a compensating experience that Dr. Timme described, there would undoubtedly be a larger incidence of diabetes. There were five diabetic deaths, and four of them were among overweights. We had, you know, about 100,000 years of life, and so I think we can dismiss that. At bottom, we do not think of these people as the pathologic group that Dr. Timme described. They are relatively few in number. On the other hand, there is a large proportion, it may run up to two per cent. of the men in our country, who are very tall men, six feet two and over.

Dr. Russell—Thank you very much, Dr. Dublin.

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Whenever cancer is discussed the name of Dr. Francis Carter Wood immediately comes to the fore. Dr. Wood needs no introduction to you. He is the most eminent man in his field. He is a graduate of the College of Physicians and Surgeons, and served his internship at St. Luke's Hospital, where he has been pathologist and attending physician for many years. He has been an Assistant Instructor, Adjunct Professor, Professor and Director

of the Department of Clinical Pathology at Columbia until 1912, when he became Professor and Director of the Institute of Cancer Research founded by George Crocker, Columbia University. He is a member of practically all of the medical and pathological societies, and has received many honors. He is the author of numerous articles. Dr. Wood brings to you the most up-to-date information in regard to cancer. I consider it a great honor and privilege to have Dr. Wood address this Association.

PRESENT STATUS OF MALIGNANT AND BENIGN TUMORS

By Francis Carter Wood, M. D.

Director, Institute of Cancer Research, Columbia University, New York

It is obvious that discussion of the various phases of the subjects mentioned in my printed title would occupy far more time than we have available and, therefore, I will confine myself to certain limited aspects of the general cancer problem in which you, as Medical Directors, are interested, without attempting a formal and complete analysis of any one phase.

In the first place, I think it will interest you to know that the experimental studies of cancer have led to a number of interesting results which will, no doubt, greatly advance our knowledge of the nature of neoplasms.

The first of these discoveries is the remarkable chemical investigation carried on by Kennaway, Cook and their collaborators at the Cancer Hospital in London. Kennaway had long been interested in the production of cancer by tar and lubricating oils, for it is in England that the occurrence of such tumors in human beings has been so frequent as to force a study of the situation from the public health point of view.

As a first step, Kennaway showed, in 1925, that a carcinogenic substance could be produced by passing acetylene (C_2H_2) through a hot tube. This proved that one carcinogenic agent anyway was a fairly simple compound, containing only carbon and hydrogen. The next step was the discovery that the carcinogenic oils and extracts from gasworks tar had a fluorescent spectrum in the ultra-violet. When the oils or the tar extracts were treated with sulphuric acid, the fluorescent spectrum disappeared and the substances were no longer carcinogenic. This pointed to the fact that these were unsaturated compounds and the fluorescence indicated a complex molecule of the aromatic series. For example, anthracene

gives a very powerful fluorescence both in the blue region of the spectrum and in the ultra-violet.

It was therefore decided to attack the anthracene group, the first step having been made in Germany by Clar, who had been working on some of the anthracenes. He produced a substance known as 1:2:5:6-dibenzanthracene and described its properties, but, being a pure chemist, was not interested in its physiological qualities. Cook began to investigate this group of compounds, of which there are many isomers, and in conjunction with Kennaway showed that the substance 1:2:5:6-dibenzanthracene was carcinogenic. Other compounds with the benzol rings in different positions were not carcinogenic. In other words, the potency lay in the stereometric arrangement of the benzol rings, and the substitution of simple radicles in the compound reduced its carcinogenic properties. The fluorescent spectrum was the same as that of the carcinogenic oils and tars.

With this lead a number of hydrocarbons were prepared, all containing the same proportion of carbon and hydrogen as the dibenzanthracene, and one or two others were found to have moderately carcinogenic qualities. It was noted that these substances possessed what is known as a phenanthrene nucleus, which is a particular arrangement in space of three benzol rings. If this nucleus was not present, the substance was not carcinogenic, even if on analysis it was found to contain the same proportion of carbon and hydrogen.

The phenanthrene nucleus has been known for a good many years as conferring upon compounds many physiological properties. So important have these compounds proved that Professor L. F. Fieser, of the Chemistry Department of Harvard University, has just published a volume on "The Chemistry of Natural Products Related to Phenanthrene" (Reinhold Publishing Corporation, New York City, 1936). For instance, the morphine and strophanthin groups of alkaloids; some of the cardiac poisons, such as digitalis; some of the resins from pine and fir trees; the sterols and bile acids occurring in the human body, among these the related and most important vitamin D, and the male and female sex hormones

are included. This is sufficient evidence of the physiological importance of the phenanthrene group.

Further studies led to the synthesis of another compound, 1:2 benzpyrene, now I believe altered to 3:4 benzpyrene, to conform with international nomenclature. These numbers only indicate the position of the benzol rings. After the preparation of this compound, which is highly carcinogenic, Cook, working on a number of tons of coal tar, separated benzpyrene, but did not find in the tar dibenzanthracene nor a further carcinogenic substance known as methylcholanthrene. It is probable therefore that benzpyrene is the carcinogenic agent in coal tar and soot, the dangerous properties of which have been known for generations.

Using his accumulated knowledge of the structure of a carcinogenic material, Cook was able to synthesize methylcholanthrene, taking as his starting point an acid occurring in human bile. The special interest of this point is that it is related to the cholesterols and thereby to vitamin D. As a matter of fact, it was shortly afterwards found that vitamin D and some of the carcinogenic agents had a moderate sex stimulating effect, thus linking them pharmacologically with the sex hormones. Truly an astounding piece of chemical synthesis. [An excellent summary of this work is given in the report made at the Second International Cancer Congress held in Brussels, September, 1936, on "Chemical Compounds as Carcinogenic Agents," Cook, Haslewood, Hewett, Hieger, Kennaway and Mayneord, of the Royal Cancer Hospital (Free), London, England.] I regard this as the greatest work in synthetic chemistry which has been done in the cancer field and it is perhaps among the two or three outstanding contributions to this baffling subject.

Practically, you may say we have plenty of cancer, why be interested in being able to produce more cancer, but this is a narrow view.

In the first place, there is the immensely important public health aspect in the isolation of these compounds. The carcinogenic material in lubricating oils can now be removed. It is probable that many other carcinogenic substances can be found belonging to this phenanthrene group. It is of the greatest importance also

to find out whether the carcinogenic activity of some of the parasites is related to these products. Whether the compounds mentioned may be found in the parasitic worms which give rise to cancer in man and animals is of course uncertain, but investigations are already under way to see if a hydrocarbon with a fluorescent spectrum of the type mentioned can be found. This means that elaborate mass analyses will have to be carried out, as were instituted for the tubercle bacillus some years ago with very profitable results, and ultimately we may be able to extract from human tissues or cancers the very substance which is responsible for our types of neoplasms.

This brings us to the question of aiding the body to eliminate this substance. In other words, a prophylactic possibility looms in the future.

In the meantime, these materials give us an opportunity to study the origin of cancer in animals under the most favorable conditions. Minute globules of solid paraffin carrying one of these compounds can be put under the skin of a mouse or rat and removed at intervals, giving us a living picture of the development of a malignant neoplasm.

Obviously, the attempt was immediately made to incite cancer in cultures of normal human and animal cells. This has uniformly failed, for reasons still unknown. But if it could be realized, we could watch under the microscope the change of the normal cell into a cancer cell, and that might tell us more about the cancer cell and its biology than we now know.

The recent discovery at the DuPont works of a number of carcinomata of the bladder has caused considerable interest. (See Gehrmann, G. H., "Papilloma and Carcinoma of the Bladder in Dye Workers," J. A. M. A. 107:1436, 1936.) Such a condition was well known in Europe but has only begun to be important in this country since the beginning of the War in 1914, when the manufacture of dyes was undertaken on a large scale in the United States. Some of the tumors are papillomata but as the actual malignancy of the tumor cannot be determined without microscopic examination, all the papillomas must be treated as malignant. As a matter of fact, analysis of 124 German cases by Ferguson,

Gehrmann, Gay, Anderson and Washburn ("Symposium on Aniline Tumors of the Bladder," J. Urol. 31:121, 1934), has shown that carcinoma is twice as frequent as papilloma.

Sixty-three men were found at Wilmington with a neoplastic disease of the urinary bladder as a result of their occupation as dye workers. Active treatment has resulted in the destruction of the tumors in 75 per cent. of the patients. This means that their disease was discovered very early and that many of the cases were papillomas or beginning carcinomas and hence could be destroyed by modern methods of treatment.

The actual substances which are the causative agents in man are not definitely known because most of these men work with different dyes, but Perlmann and Staehler (Klin. Wchnschr. XI:1955, 1932; Ztschr. f. Urol. 27:195, 1933; ibid. 36:139, 1933), have been able to produce tumors in the bladder of rabbits by subcutaneous inoculations of various amino compounds. The majority of the tumors occurred with beta naphthylamine and one only with aniline, neither containing a phenanthrene group.

Adequate measures of protection in Germany have been so successful that no new cases have developed in the men employd in the factories with modern facilities for ventilation. No doubt this will be immediately applied at the DuPont works and this particular disease will disappear. It is wholly an industrial problem just as are tar, soot and oil cancers, all of which will diminish when proper measures for cleanliness are taken.

Another investigation which touches upon matters of life insurance rather closely is the possibility of the hereditary relationships in cancer. The most important studies on this subject, I am happy to say, have been made in the Crocker laboratory, using a worm which after infesting the rat causes the development of cysts in the liver and ultimately, in a certain percentage of the animals, neoplastic growths. A very large number of tumors were produced by this process and when the data were analyzed it was found that no genetic relationship could be established as to the appearance of a tumor, except the amount of irritation, which was determined by counting the number of cysts which formed, and the length of life of the animal. ("Duration and Extent of Irritation versus

Genetic Constitution in the Etiology of Malignant Tumors," Curtis, Dunning and Bullock, Am. J. Cancer, 21:554, 1934.)

This removed the question of cancer from the germ cells to the somatic tissues and it was shown that the occurrence of cancer followed a probability law; in other words, it was a random phenomenon appearing in the course of the growth and division of a large number of cells under the influence of an irritating substance secreted by the worms. If the worm died, no cancer was found. If there were only one or two cysts, the animal might not have cancer. If there were many cysts, the animal invariably had cancer.

Reproduction of this work, using multiple nodules of paraffin carrying dibenzanthracene or benzpyrene, showed that exactly the same relationship holds. With small doses of these chemicals, cancer might not occur unless the animal lives for a long time. If large doses were used, 100 per cent. of the animals developed the disease, and there is a high correlation between the number of nodules and the frequency of the appearance of cancer. ("The Respective Rôles of Heredity and Somatic Mutation in the Origin of Malignancy," Dunning, Curtis and Bullock, Am. J. Cancer 28:681, 1936.)

The importance of this work, which has been demonstrated in both mice and rats, is obvious. To avoid cancer, see that the body is free from irritative processes. The occurrence of cancer in the mouth of people who are not especially clean, have bad teeth or ill-fitting dentures, is a demonstration of the same situation and points to an effective prophylaxis.

A third discovery of importance, also made in my laboratory, by Dr. Charles Packard ("A Biological Measure of X-ray Dosage," J. Cancer Research 11:282, 1927, and "The Biological Roentgen," Radiology 27:191, 1936), is that the eggs of the small fruit-fly Drosophila form excellent biological material for the measurement of X-rays and radium rays. They are not subject to the variations and irregularities which are inherent in most physical methods. They are admirably adapted to the calibration of commercial X-ray measuring apparatus and to the experimental investigation of the distribution of radiation in the body.

The question of the chemistry of the sex hormones and their effect on cancer is still in the experimental stage. Claims have been made that carcinoma of the cervix has been produced in animals by the injection of theelin, but what was produced was not a carcinoma. The injection of theelin into animals has been said to cause cancer, but the number of cancers produced was small and there is a question whether impurities or irritating substances in the oil in which the theelin was administered may not have played an important part in the development of a tumor.

It must be remembered that in all this experimental work quantities of hormones are administered which are far beyond any possible norm and, therefore, it is no wonder that strange effects are produced, but so far I do not think it has been shown that there is any definite correlation between the production of cancer and the administration of sex hormones. You will immediately counter with the statement that Lacassagne administered theelin to male mice who never had cancer of the breast and produced cancer of that organ, but unfortunately Lacassagne did not produce cancer of the breast. What he did was to begin the injections very early to preserve the rudiments of the breast in the male mice, which would otherwise atrophy in a few weeks, but when the male mouse had a functioning breast like his sister he developed cancer for the same reason that his sister did. In other words, the whole action was indirect. ("Un cancer d'origine hormonale de l'adénocarcinome mammaire de la souris," A. Lacassagne, Paris méd. 1:233, 1935. Abstr. Am. J. Cancer 27:139, 1936.)

There are a host of other interesting and important advances from various aspects but they cannot be considered here.

On the clinical side, progress has been slow. Surgery is improving and the methods of applying X-ray and radium are becoming more and more effective with our increased knowledge based upon the study of clinical material. However, this is always a slow procedure and no sudden advances may be expected. With any present method of therapy the number of cures probably amounts to less than 15 per cent. of those applying for help in the large cities, and, in the less favorably situated districts medically, to even less.

The answer to this problem is more intense education. But education is difficult. It must be continually repeated; each new generation requires fresh effort; and even with the mobilization of the public health activities, the demonstrations by the American College of Surgeons, and the lay teaching by the members of the American Society for the Control of Cancer, our progress is still slow. The educator has to sail between the Scylla of indifference and the Charybdis of cancer phobia. I sometimes think that cancer phobia should become general, but the medical profession must be prepared to cure this phobia, and the best excuse is that untreated cancer is always fatal while the hysteria, annoying as it may be to the persons in contact with the victim, is a disease from which no one dies.

While much has been done to study statistically the results of surgery and the efficiency of X-ray and radium, as regards a body of accurate information, this field has scarcely been scratched. In the first place, the physician must be educated to recognize cancer. In the second place, the cancer patient must be placed in an intelligent medium where every possible diagnostic method is available. Fragments should be removed from a tumor and studied under the microscope with modern technique. The pathologist is too often somewhat meagerly equipped. The records kept are poor. The patients, especially in the large cities, disappear and the ultimate fate after any form of treatment cannot be determined. There has been too slow a development of institutional care for the cancer patient and not sufficient growth of cancer clinics where physicians may not only teach but, also, what is more important, learn what is taking place in the scientific world.

These are not matters which can be legislated or hurried, but slowly it is being realized that the cancer patient is a special subject and the disease cannot be treated by one individual alone. The surgeon needs all the help he can get from the radiologist and pathologist. The radiotherapist needs a host of facts, among them an accurate diagnosis of the tumor and a mass of information, which is not yet available, concerning the biological sensitivity of the tumor, how fast the applications of radiation should be made, etc. One may witness in the same city and in large institu-

tions the most incompetent treatment side by side with the best. In the country, far from the county or city hospital, the treatment is often of absolutely no avail. Nevertheless, the American College of Surgeons has done much to encourage the establishment of cancer clinics, as has the American Society for the Control of Cancer. The College is furnishing standard blanks for the recording of the essentials of the cancer case and is attempting to build up the defective clinics in the country.

Another hopeful sign is the appearance on the scene of the International Union Against Cancer, which was organized in Paris several years ago and is now a going concern, with membership from all over the world. The International Union recently held an interesting and informative congress in Brussels, notable for the large amount of experimental work which was reported and the small amount of rubbish. Two of the committees are actively engaged in trying to produce results of value.

The Committee on Statistics, which enjoys the ripe judgment of our statistical colleague, Dr. Louis I. Dublin, and some of the best minds in Europe, has shaped a program for the improvement in the recording and classification of cancer statistics, and, if adopted, this will mean better statistical records for analysis some ten or twenty years from now.

The other committee has, to use the vernacular, pinned upon the speaker the task of producing a "Diagnostic Atlas of Tumors," which will be published at a price permitting every laboratory and every pathologist to possess a copy. It is intended that this Atlas shall illustrate not only all known types of cancer, but also the difficult transitional forms between the benign and malignant conditions and thus enable anyone to match a slide which he receives from a given organ with one photomicrographed in the Atlas. This will obviously synchronize diagnosis on the basis of morphology and not on nomenclature and permit the classification of tumors according to the numbers of the cuts in the Atlas. This may seem a useless refinement, but if we are ever going to know anything about the sensitivity of a vast number of types of human cancer to radiation; know anything about their natural history, which concerns the surgeon; know anything about the prog-

nosis in either form of treatment, we shall have to segregate the groups of tumors, for tumors, resembling each other very closely, may possess vastly different biological properties. I feel that this Atlas will be a great step toward laying a foundation not only for the diagnosis of tumors, but also for a wider biological evaluation of their peculiar qualities, and this is the point in which you are interested.

Another question which often arises is how important is the grading of tumors. I think it is generally acknowledged at the present time that the grading of tumors, which is not new and has been done by pathologists for many years in a rough way, has a certain value, provided too many assumptions are not made. It has no weight for the individual case, as what a tumor will do in a person cannot be told from a microscopic examination of the tumor tissue, but it has a certain value in groups of cases. For example, it is generally known that the gelatinous carcinomata of the breast offer much better prognosis than the scirrhous forms. On the other hand, an individual case of gelatinous carcinoma may die while an individual case of scirrhous carcinoma may survive. A certain value is attached to grading from the point of view of susceptibility or resistance to radiation, but here again there are exceptional cases and the individual result cannot be forecast.

The tumors of the salivary gland are a difficult group to analyze because about one-half of them are apparently quite benign and never return if completely excised. The excision is not always thoroughly done because the surgeon is afraid of cutting the facial branches of the fifth nerve and thus producing a facial paralysis, so that we see in practice a considerable number of recurrences which remain local and if again removed, regardless of the nerve, will stay permanently well. On the other hand, there are borderline tumors which are of low malignancy and recur despite surgery, and resist radiation. Then there is another group of highly malignant salivary carcinomata which no type of therapy influences.

In other words, the whole question of the possibility of insurance in this group of tumors, even with high loading of a policy, turns upon a careful microscopic study of the tumor by an expert who is familiar with this particular group and who will be able to say

from the morphology of the section whether the neoplasm is malignant and, therefore, the person should not receive insurance or whether, after five or more years, insurance could be placed.

There is a good deal of talk among the clinicians about precancerous lesions, chiefly those occurring on the skin and on the cervix. There is still some doubt as to whether a precancerous lesion is necessarily followed by cancer and no exact statistics exist on the matter. One of the lesions of the mucous membranes commonly considered as precancerous is leukoplakia. The responsibility of leukoplakia for the appearance of cancer is a difficult question to answer with any dogmatism. White spots or areas are common in the mouths of smokers, especially if they have had syphilis. So long as these remain thin and soft they are not dangerous. The type which is dangerous is that which involves the tongue and causes deep fissures in the mucous membrane of that organ or forms warty masses on the cheek, tongue, floor of the mouth, or elsewhere. This type should be very carefully watched and unless the disease disappears, the persons, in my opinion, should be insured with considerable caution. It is probable, though there is no absolute proof, that cancer develops more frequently in these areas than in a healthy mucous membrane. However, it is possible to cure even this type of leukoplakia and if the patient keeps away from tobacco and irritating foods, it is not likely to return, in which event the persons become insurable at standard rates.

Among the benign tumors, the fibromyomata of the uterus are still in many instances excised. As a rule the cervix is left and in about one per cent. of such cervices carcinoma may appear at a later date. If the patient is in the younger age groups, radiation with X-ray is now replacing surgery to a very large extent. Radiation destroys the activity of the ovaries and induces an artificial menopause. As a rule, the uterus shrinks to a small size, as it does after a natural menopause. These small atrophic uteri are much less likely to have carcinomata appear in the cervix or body of the uterus because all stimulation of the mucous membrane of the uterus ceases with the atrophy of the ovaries. The recurring

monthly congestion and the presence of the ovarian hormones in excess may be partially responsible for cancer of the cervix.

A person who has been cured of a fibromyoma of the uterus by radiation, therefore, is perfectly insurable. Younger women who have been operated on between the ages of 35 and 45 still have the possibility of developing a carcinoma in the remaining cervix. They therefore should not be regarded as any safer risks than the woman who has borne children and not had a fibroid.

I have seen no evidence, however, that carcinoma of the cervix in an amputated stump is any more likely to occur than under normal conditions and, as you know, carcinoma of the cervix is one of the important types in the female.

But to turn from generalities to some consideration of the recorded facts concerning cancer, it may be stated as a preliminary that more than twenty years ago I read a paper in Birmingham, Alabama, before a group of life insurance physicians in which a definite statement was made that no patient who had ever had cancer was a good risk, and that is very nearly true today. If any exceptions are to be made, they will require a very careful study of the individual patient, taking into consideration the microscopic report on the nature of the tumor, the skill of the surgeon, still a difficult matter to estimate, and the effectiveness of radiation, if that has been the form of treatment employed, and which is still more difficult to evaluate. The best test of all these matters is, obviously, time. If a patient has been treated for cancer and is alive ten years later, it is evident that an assumption may be made that he is cured, but, as a concrete example of the difficulties which we are discussing, I might cite a recent paper by von Hippel, (Graefe's Arch. f. Ophth. 135:76, 1936), recording the results of a follow-up of 118 sarcomas of the eye. Von Hippel calls attention to the fact that in about one-third of the cases the recurrences took place after five years and hence a ten-year period gives more accurate results, but after ten years only about one-fifth of von Hippel's patients were alive. I have seen eye sarcomata, and there are many others on record, in which the recurrence took place after twenty years. Hence, sarcoma of the eye should be excluded from insurable material.

Cancer of the skin is another very favorable field, but still we see cancer of the skin recur ten years after treatment by radiation, the most frequently used form of therapy at the present moment. True, a second attack can be made on the recurrence, but often with doubtful results.

The whole question of insurance, then, lies in an accurate knowledge of the type of tumor of the skin. If it is of the so-called basal cell group, permanent cures are obtainable in about 90 per cent. of the cases. But there is another aspect. Most of those who have a basal cell tumor are in the age groups of 55-60 and above, hence are less interesting from an insurance point of view. Another example is carcinoma of the cervix, which is a favorable type for treatment with radium and X-ray, but in the best hands the total statistics of five-year cures amount to only 23 per cent., and there are a number of patients who have recurrences after five years. Thus the reports of 30, 40 and 50 per cent. of cures published by certain clinics are from purely selected material.

From an insurance point of view, it is difficult to see how any judgment can be made five years after the patient has been treated, as to whether such treatment has been effective or what might be the prognosis of the individual case. There is a vast body of neoplasms which need not be considered at all for insurance purposes because the disease is almost always fatal, and this includes cancer of the brain, of the lung, of the stomach, of the bladder, of the pancreas, of the kidney, of the adrenal, of the prostate, the bone sarcomata and other rarer types. On the other hand, there is a growing tendency among insurance companies to inquire as to the insurability of persons with testicular tumors after a five-year period. The situation is rather anomalous, for I should suggest that only those persons who have a highly malignant type of testicular tumor should be insured as they will almost certainly die in a short time, usually within two or three years, but if they are alive after five years, they may be insurable, with discretion. I should be glad to see the insurance companies take on a considerable number of these patients because we would then have a better follow-up than can be obtained in hospital work. Patients will often ignore the doctor's requests, but if they continue to

pay premiums it is obvious that they are still alive. All the teratomata and the less malignant types of tumors of the testicle are quite apt to recur after five years and, therefore, should not be insured.

All this implies, as you will see, wide knowledge and expert opinions on the type of tumor, and I think it would be wise for insurance companies to keep slides of all the cancer cases that they insure in order not only to protect themselves, but that if there should be an unexpected death, to be able to study the material with the idea of avoiding future mistakes.

On the whole, then, the cancer patient is undesirable, he is in the older age groups and he has an indeterminate life. The young do not come into consideration, for the malignant tumors of the young are, as a rule, of the rapidly destructive type. What the situation may be ten or twenty years from now, when the actuarial facts concerning this difficult subject are available and better statistics are obtainable from the medical literature, I cannot say. True, it is possible for the American College of Surgeons to publish in the course of three or four years 25,000 cured cases of cancer, but these are selected from some millions of examples, the remainder having died of the disease, and also are nearly all limited to the few regions in which surgical treatment is effective, i.e., the skin, the breast, the lip, the uterus, and the rectosigmoid.

Dr. Russell—Thank you, Dr. Wood. I know we are all very grateful to you for this splendid address. I am sure that Dr. Wood will be pleased to answer any questions.

I understand that Dr. Pollard, Associate Medical Director of the Prudential, has some interesting figures to present at this time regarding the cancer experience of his Company.

Dr. Pollard—This is not intended in any way to be a discussion of Dr. Wood's paper as we do not pretend to be able to add to the facts as brought out by Dr. Wood, and when we were asked by Dr. Russell to give some of the experience of the Prudential in regard to cancer we told him we would be glad to offer to the Association anything we could, though in going over the subject with Mr. Shepherd, our Assistant Actuary, we felt

we could not offer a great deal of information. We will, however, try to present some of our experiences and hope they will be of interest to you.

Our ratio of cancer deaths to the total deaths during the six-year period, from 1930 to 1935, inclusive, is as follows:

Males

Age at Death	1930	1931	1932	1933	1934	1935
Under 20	1.66	1.10	1.16	2.27	3.85	1.84
20–29	2.15	2.36	3.25	2.68	2.91	3.48
30–39	4.57	4.86	4.75	4.91	5.46	6.01
40–49	8.98	8.63	10.2	9.83	9.85	10.9
50–59	14.0	13.3	13.3	13.6	13.7	14.0
60–69	14.0	15.9	16.7	14.3	15.0	15.5
70 and over	12.1	12.5	12.5	13.0	13.5	13.3
All ages	10.4	10.8	11.5	11.2	11.7	12.3

Females

Under 20	1.43	1.47	1.47	.....	1.92	2.63
20–29	3.01	2.19	4.73	4.27	3.72	1.92
30–39	10.5	10.5	10.3	11.9	14.0	14.8
40–49	22.6	23.9	25.4	24.1	26.6	25.9
50–59	23.8	24.2	24.5	26.0	27.4	25.5
60–69	17.0	17.6	16.9	18.9	19.9	20.8
70 and over	14.8	11.6	12.3	12.0	13.0	11.4
All ages	16.2	16.3	17.2	17.7	19.4	18.7

The number of cancer deaths we had in 1935 was 2,965.

We have reviewed some of the death claims, for cancer, which we received in or about June of this year. (These were 152 in number and, while there were a few either just before or just after June, we have included them, so that it would be better to consider them as recent cases.) These 152 claims were distributed, in location of the cancer, as follows:

	Males	Females
Head or face	4	----
Neck	5	----
Digestive tract	56	31
Urogenital	11	3
Breast	----	8
Uterus	----	7
Elsewhere	20	7

Of these 152 cases fifteen were on policies which had been in force less than five years. The ages were principally from 41

upward, only eight occurring under that and the largest number between the ages of 61 and 65.

There was one of these cases between 21 and 25, a young man aged twenty-four, who was ill only seven months and the diagnosis at death was Sarcomatosis Osteogenic.

There was nothing distinctive about the occupation or grade of society in these 152 cases.

I do not know whether or not you have all seen and read the draft of a report which will be presented to the Council of the Actuarial Society on October 24. This covers issues of the years 1920 to 1934, carried to the anniversaries in 1935, and shows under Code 152, Cancer with operation, one attack within three to ten years of application, standard and substandard, 57 deaths with 27.65 expected deaths, a ratio of 206 per cent. ± 19 and the Company ratings averaged 210 per cent. It is our practice not to accept these cases until five years after the removal and apparent cure of the cancer and then only with a heavy rating ($30. per $1,000 extra for five years, in the sixth year), and we do not issue standard until the eleventh year and later.

The Codes 153, 154, Epithelioma, which in the M.I.S. showed a ratio of 110 per cent. ± 14; the Company ratings averaged 155 per cent. Our action in these cases is somewhat more lenient, in that those cases not definitely diagnosed microscopically as basal-celled epithelioma and removed surgically are taken by us in the fifth year with a rating of $12.50 per $1,000 for five years and are given standard insurance in the tenth year. Those cases definitely diagnosed microscopically as basal cell we issue in the second year with a rating of $10 for four years, and give standard in the sixth year.

Dr. Russell—Dr. Wood has kindly consented to answer any questions about either malignant or benign tumors. I wish that some of you would ask questions to lead this discussion.

Dr. Scholz—Dr. Russell and Dr. Wood, I think many of us have been confronted with the status of the cancer test.

Dr. Russell—I will ask Dr. Wood to close the discussion.

DR. WOOD—Cancer Tests—I presume that by this question is meant the chemical or serological tests which have been devised during the past few years for the detection of cancer. These tests are usually positive in some 75 to 85 per cent. of cancer patients, though a good many give poorer results than this. In general these serological or chemical reactions are not given by patients with small tumors, which are just the ones in which the diagnosis is important. As a matter of fact, many of the tests are not specific for cancer, but are a revelation of changes in the blood due to the growth of tissues in the body, for they are also, in many instances, given by pregnant women as well as those with large growing cancers. That is, the growth of the child in the body has the same effect on the organism of the female individual as the growth of a tumor. Of course, in males that complicating factor can be excluded and, therefore, in the male a fairly satisfactory diagnosis may be obtained. But there is no known test which gives 100 per cent. of positive results in cancer patients. Many of these tests are extremely complicated and, as they are not sufficiently accurate, have been abandoned, because in most instances X-ray or ordinary physical diagnosis will reveal a tumor which gives a positive test. On the other hand, the Aschheim-Zondek test for the anterior pituitary hormone has been extremely useful in determining the presence of metastases from chorioepitheliomata in the female and from testicular teratomata in the male.

Damage from X-Ray—The wide use of X-ray has resulted in a certain number of serious injuries to the skin and such injuries may express themselves in the appearance of a cancer at a later date. The usual period which elapses before such tumors appear is some six or eight years. The type is generally a squamous cell carcinoma, though sarcomata of the subdermal tissues have been described. The older form of radiologist's cancer has disappeared, but the new therapy type is of considerable importance and warrants a careful physical examination of a patient who has had extensive X-ray for a lesion other than cancer. For the cancer patient, obviously, there is a double risk in the return of the tumor and the development of a new growth in the area which has been damaged by the radiation.

Dr. Russell—Thank you very much, Dr. Wood.

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Gentlemen, this concludes the papers and presentations. In opening our Convention, I stated as well as I could my pleasure in serving as President of the Association and my appreciation of the honor of being chosen to serve as such. I want deliberately to repeat what I said, if you will permit me. I have enjoyed my term of office, and I warmly thank all those members who have aided me in the work. My Presidency has been a year of honor and satisfaction to me. I hope our incoming President will have equal pleasure and satisfaction. In behalf of the Association I thank all those who have participated in the Proceedings and all those who have helped us in any way, and those of this hotel establishment who have ministered to our comfort and convenience.

There are one or two things I do want to say before we adjourn for a year. It is finely courteous of you to attend this closing and I am sure you will bear with me a few moments. There is one particular thing that has struck me in our convention; in fact, always has. The fraternal spirit of this Association is splendid, and the desire and effort to be of mutual aid in a great cause is remarkable; as far as I can see, free from any jealousy of standing or connection. This body shows its realization of the duty with which it is charged and its members are worthy of the responsibility of their high posts.

Gentlemen, our meeting is over. May I express the hope that the coming year may give satisfaction in carrying on the "work of selection" to the advantage of our profession, this Association and the cause of life insurance.

Before relinquishing the chair to your new President, I want to thank our able Secretary, Dr. Dewis, for his kindly assistance and coöperation. Our Association is indeed fortunate in having such an efficient Secretary.

It now gives me great pleasure to present to you your new President, Dr. Chester T. Brown.

Dr. Brown—I wish to express a heart-felt and deep appreciation for the honor which you have bestowed upon me. Come Sunday, I shall have been a member of this Association for twenty years. I have always considered as a good omen the fact that I became a member of this Association on the same day of the year that I became a member of the human race.

It has been my privilege to hold elective office since 1923. For eight years I was your Secretary. I have come to love the Association and to have a warm and high regard for all its members, many of whom I number among my best friends. May I congratulate the retiring President on the excellence of his program and the high quality of the meeting which we are now bringing to a close? And may I bespeak your help, your aid, your patience, your sympathy, in the coming year.

As we come to the end of the formal portion of our meeting and as we return to our homes and to our individual duties, may God bless you and bring you all back next year!

Dr. Fraser—I move that this Association express its appreciation and thanks to Dr. Russell for the capable manner in which he has administered his office and for the excellent quality of the papers and the discussions which he has prepared for us.

* * * * * *

This motion was carried unanimously. Dr. Russell tendered his thanks to the members for this expression of appreciation. Whereupon, the meeting was adjourned.

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William F. Hamilton, M. D.	Sun Life, Montreal, Quebec.
George A. Harlow, M. D.	Northwestern Mutual, Milwaukee, Wis.
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Walter C. Hausheer, M. D.	Prudential, Newark, N. J.

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Ernest M. Henderson, M. D.	Confederation Life, Toronto, Ont.
Carroll E. Herron, M. D.	Ohio State Life, Columbus, Ohio.
William L. Hilliard, M. D.	Equitable Life, Waterloo, Ont.
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John M. Livingston, M. D.	Mutual Life of Canada, Waterloo, Ont.
G. Carroll Lockard, M. D.	Maryland Life, Baltimore, Md.
H. Clive McAlister, M. D.	Lincoln National, Ft. Wayne, Ind.
Milton T. McCarty, M. D.	Peoples Life, Frankfort, Ind.
George McCreight, M. D.	Bankers Life, Des Moines, Iowa.
Francis H. McCrudden, M. D.	New England Mutual, Boston, Mass.
Carleton B. McCulloch, M. D.	State Life, Indianapolis, Ind.
Albert A. MacDonald, M. D.	National Life of Canada, Toronto, Ont.
Arthur J. McGanity, M. D.	Dominion Life Assurance, Waterloo, Ont.
William A. McGuire, M. D.	General American, St. Louis, Mo.
Lewis F. MacKenzie, M. D.	Prudential, Newark, N. J.

Walter T. McNaughton, M. D.	Old Line Life, Milwaukee, Wis.
Frederick W. McSorley, M. D.	Equitable Life Assurance, New York City.
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Henry L. Mann, M. D.	Equitable Life Assurance, New York City.
Robert W. Mann, M. D.	Imperial Life, Toronto, Ont.
William L. Mann, M. D.	Great West, Winnipeg, Man.
Oscar F. Maxon, M. D.	Franklin Life, Springfield, Ill.
Samuel W. Means, M. D.	Metropolitan Life, New York City.
William H. Miller, M. D.	Equitable Life Assurance, New York City.
James T. Montgomery, M. D.	Southland Life, Dallas, Texas.
Richard C. Montgomery, M. D.	Manufacturers Life, Toronto, Ont.
John F. Moore, Jr., M. D.	Mutual Life, New York City.
William D. Morgan, M. D.	Phœnix Mutual, Hartford, Conn.
William Muhlberg, M. D.	Union Central, Cincinnati, Ohio.
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James Norman, M. D.	National Life Assurance, Toronto, Ont.

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Author Index

1920-1936

NOTE—Titles of Original Papers in Plain Type; of Papers Discussed, in *Italics*

	Volume	Page
Alton, C. D. *Medical Examiners and Insurance Companies*	XVII	278
Mortality in Southern States	XVII	239
Alvarez, W. C. *Disability Insurance*	XXII	133
Selection and Gastric or Duodenal Ulcer	XXII	50
Tempo of Development and Decay	XXII	220
Amiral, H. H. Diastolic Pressure and Cardio-Respiratory Test	XIV	219
Anderson, H. B. Focal Infections and Life Insurance	IX	144
Gassing and Shell Shock	VI	88
Influenza	VI	71
Archibald, T. D. Tuberculosis of Bone, Joints and Insurability	XIV	310
Gassing and Shell Shock	VI	86
Impaired Risks, Canadian Companies	IX	254
Life Insurance Without Examination	XII	253
Bailey, W. C. Report on Diastolic Blood Pressure	XI	143
Juvenile Tuberculosis	XIV	337
Baker, B. M., Jr. *Coronary Sclerosis*	XXI	176
Baker, H. A. Non-Medical Factors Affecting Mortality	XII	211
Life Insurance Without Examination	XVIII	138
Murmurs and Irregularities	XI	123
Non-Medical Mortality	XV	287
Syphilis	XIII	41
Women as Life Insurance Risks	XVI	336
Balch, A. W. *Diabetes and Life Insurance*	VIII	109
Metropolitan Laboratories	X	124
Sugar in Urine, Detection of	VII	330
Barker, L. F. Nervous or Mental Disease and Selection	XX	76
Barnes, A. R. Coronary Sclerosis as Insurance Problem	XXI	154

	Volume	Page
Bartlett, W. B. Life Insurance Without Examination	XVIII	121
Pneumothorax	XX	90
Aviation and Life Insurance	XIV	141
Coronary Sclerosis as Insurance Problem	XXI	181
Human Element in Aviation	XVII	161
Medical Selection and Pleurisy	XIX	222
Pleurisy	X	197
Bassford, H. R. Blood Pressure Mortality and Diastolic Readings	XIX	77
Hypertension as Underwriting Problem	XXI	220
Interpretation of Blood Pressure	XIX	153
Battle, J. T. J. Tuberculosis from Insurance Viewpoint	XV	266
Beckett, W. W. Presidential Address	XIV	6
Tuberculosis and Life Insurance	IX	115
Appendicitis	VII	280
Disability Benefit in Life Policies	XI	323
Female Risks With Pelvic Operations	VI	46
Influenza	VI	72
Medical Examiners for Life Insurance	XII	129
Public Health	VII	81
Beckett, W. W., MacEwen. Disability Insurance	XIV	17
Behre, J. A., Muhlberg. Acetone, Urinary and Life Insurance	XVI	167
Benedict, S. R. Metropolitan Laboratories	X	111
Blood Tests	XVII	329
Glycosuria and Selection	XI	229
Laboratory Tests—Albumin, Sugar, Acetone	XVI	182
Sugar in Animal Body	XIV	433
Birchard, C. C. Arterio-Sclerotic Heart	XVIII	217
Mitral Stenosis	XXII	165
Electrocardiogram in Life Insurance	XX	176
X-ray and Electrocardiographic Examinations	XIX	29
Blaivas, A. J. *Kline Precipitation Tests for Syphilis*	XIX	287
Blakely, D. N. *Albumin in Urine*	IX	270
Diabetes and Life Insurance	XVIII	283
Blatherwick, N. R. Blood and Urine Sugar After 50 Gms. Cane Sugar	XVII	310
Diabetes and Selection	XVIII	281
Blatherwick, N. R., Ewing. Field Glucose Tolerance Tests	XIX	254

	Volume	Page
Blatherwick, N. R., Folin. Blood Sugar Curves After 50 Gms. Glucose	XVI	155
Boas, Franz. Tempo of Development and Decay	XXII	212
Bolt, William. Hypertension as Underwriting Problem	XXI	183
Bradshaw, W. M. Focal Infections and Life Insurance	VII	222
Albumin, Glycosuria	IX	272
Cardiac Enlargement, Visibility Apex Beat	XVIII	29
Epidemic Encephalitis	XVII	134
Flarimeter Tests	XVII	36
Glycosuria	XV	122
Glycosuria and Selection	XI	237
Goitre	XI	285
Impaired Lives	XII	88
Significance of Albuminuria	XXII	14
Bradshaw, W. M., Carber. Glycosuria and Insurance Medicine	XV	66
Brathwaite, F. G. Cardiography, Oscillometry and Selection	XVI	19
Glycosuria: Charts	XV	100
Glycosuria: Selective Formula, Mortality	XX	52
Heart Problem of the Worker	XVII	74
Murmurs and Longevity	VI	206
Brown, C. T. Female Risks, Pelvic Operations: Selection, Mortality	VI	31
Glycosuria	X	228
Impaired Lives	X	52
Numerical Ratings	VII	214
Brown, D. C. Trustee American Medical Association. Address	XVIII	162
Brown, F. R. Study of Urinary Analyses	XIV	343
Laboratory Tests: Albumin, Sugar, Acetone	XVI	192
Brown, Lawrason. X-ray in Diagnosis Pulmonary Tuberculosis	VII	343
Campbell, E. J. *Medical Impairment Study, 1929*	XVIII	80
Significance of Systolic Murmur	XXI	126
Carber, F. H. New General Code of Impairments	XIX	188
Present Status of Goitre	XI	270
Pyuria	XVII	347
Carber, F. H., Bradshaw. Glycosuria and Insurance Medicine	XV	66

	Volume	Page
Caulfeild, A. H. W. *Mortality of Asthma*	XX	210
Chadwick, H. D. Diagnosis, Prognosis of Juvenile Tuberculosis	XIV	327
Chamberlain, W. E. Pitfalls in X-ray Diagnosis	XXIII	125
Chambers, R. M. *Human Element in Aviation*	XVII	151
Chapin, L. D. *Arterio-Sclerotic Heart*	XVIII	233
Focal Infections	VII	241
Impaired Lives	IX	186
Chapman, J. P. *Pyuria*	XVII	350
Chapman, J. P., Dillard. Standardization of Examination Blanks	VIII	169
Chargin, Louis. *Kline Precipitation Test for Syphilis*	XIX	286
Christiernin, C. L. Presidential Address	XIX	14
Clark, C. P. Blood Pressure, Heart Size, Body Surface Area, Metabolism	XX	224
Chest, Abdominal Measurements: Height and Weight	XVI	341
Mortality from Build Using Index W/H_3	XXIII	46
Pyuria	XVII	338
Study of Tables: Average Weights for Heights	XXII	266
Circulatory Impairments	XVIII	44
Impaired Lives	XII	92
Weight Standards, Mortality: Very Tall Men	XXIII	197
Clark, C. P., Kingsbury. Demonstration Urinary Tests	XI	250
Coburn, Arthur. *Numerical Method of Selection*	VI	167
Cook, H. W. A Visual Guide to Albuminuria	IX	277
Cardio-Vascular-Renal Degeneration	XIV	250
Abnormal Pulse	XV	218
Blood Pressure in Relation to Heart Size, etc	XX	247
Cancer	VIII	260
Cardiac Enlargement: Visibility of Apex Beat	XVIII	25
Coronary Sclerosis	XXI	163
Functional Tests of Circulation	XVI	135
Group Insurance	VII	181
Heart Problem of the Worker	XVII	71
Large Risk Underwriting	XVIII	101
Medical Relationships of Life Insurance	XXII	244
Mitral Insufficiency	XIII	203
Myocardial Degeneration	XV	218
Numerical Ratings	VII	216
Pulse in Life Insurance	XIII	272

	Volume	Page
Cort, P. M. *Blood Tests*	XVII	322
Field Glucose Tolerance Tests	XIX	270
Intermittent Glycosuria	XV	125, 136
Laboratory Tests—Albumin, Sugar, Acetone	XVI	185
Pulmonary Tuberculosis, Changing Attitude	XXIII	113
Cragin, D. B. Chairman, American Life Convention, Med. Sect.	XXIII	17
The Colorimeter	XIII	194
Abnormal Pulse	XV	234
Cardiography, Oscillometry and Selection	XVI	35
Diabetes and Life Insurance	XXI	93
Electrocardiogram, X-ray and Ordinary Issue	XVIII	208
Glycosuria: Formula and Mortality	XX	69
Medical Relationships of Life Insurance	XXII	256
Mortality Southern States	XVII	227
Myocardial Degeneration	XV	234
Non-Medical Mortality	XV	298
Prostatic Obstruction	XXII	202
Surgery Digestive Organs	XVI	225
Craig, J. D. Disability Benefit in Life Policies	XI	294
Crawford, G. E. Practical Observations on Taking Blood Pressure	XI	38
Crohn, B. B. *Selection and Gall Bladder Disease*	XXI	80
Cullen, George. *Women as Life Insurance Risks*	XVI	332
Daley, R. M. Diabetes	XV	76
Medical Directors	XV	46
Presidential Address	XV	12
Albuminuria and Casts	VIII	296
Glycosuria	X	223
Syphilis	XIII	39
Davenport, C. B. *Weight and Mortality, Very Tall Men*	XXIII	182
Dechert, Robert. *Disability Insurance*	XXII	125
Dewees, E. J. *Flarimeter Tests*	XVIII	249
Dewis, E. G., MacKenzie, Wells, Ylvisaker. Flarimeter Tests	XVII, 8; XVIII	239
Functional Tests of the Circulation	XVI	36
Dillard, H. K., Chapman. Standardization Medical Blanks	VIII	169
Dillon, E. S. Diabetes Mellitus and Life Insurance	XXI	96
Intermittent Glycosuria	XV	131

	Volume	Page
Dingman, H. W. Disability and Digestive Disorders	XVI	285
Disability Insurance	XII	263
The Doctor and Insurance	XIV	295
Epidemic Encephalitis	XVII	137
Medical Selection and Pleurisy	XIX	225
Dublin, L. I. Dreyer Measurements, Committee Report: 1924—XI, 28; 1925—	XII	204
Dreyer, Work of: Anthropometrical Supplement to Report	X	162
Dreyer, Work of, and Life Insurance	VIII	202
Relation Between Cancer and Overweight	XV	402
Occupation and Mortality	VII	135
Pulmonary Tuberculosis, Changing Attitude	XXIII	117
Scapular Types and Longevity	X	89
Tempo of Development and Decay	XXII	217
Dublin, L. I., Jimenis, Marks. Gall Bladder Disease, Selection	XXI	34
Gastric or Duodenal Ulcer and Selection	XXII	24
Dublin, L. I., Knight. Tuberculosis, Metropolitan Life Ins. Co. Sanatorium, 1914-27	XV	247
Dublin, L. I., Marks. Asthma, Mortality of	XX	191
Pleurisy, Medical Selection	XIX	203
Weight Standards, Mortality of Very Tall Men	XXIII	153
Dunham, Kennon. X-ray Chest Examinations	IX	132
Dwight, E. W. Cardiac Functional Tests	IX	203
Selection by Methods Other Than Numerical Rating	VII	184
Albuminuria and Casts	VIII	304
Appendicitis	VII	279
Cardio-Respiratory Test	XII	67
Glycosuria and Selection	XI	238
Murmurs and Longevity	VI	194
Overweights	XII	51
Pulse in Life Insurance	XIII	260
Eads, J. T. Significance of Epigastric Pain	XX	103
Eakins, O. M. Medical Directors	X	128
"Mistakes"	XIV	46
Numerical Ratings in Selection	VII	194
Impaired Lives	IX, 185; XIII	190
Insurance Record and Selection	XIII	78

	Volume	Page
Eakins, O. M.—Continued:		
Interpretation Statistical Principles	XXIII	87
Medical Relationships	XXII	253
Non-Medical Factors and Mortality	XII	218
Ratings Principal Impairments	VIII	163
Ecker, F. H. Address of Welcome	VIII	5
Elliott, J. H. *Pneumothorax*	XX	95
English, C. H. *Epilepsy*	IX	112
Erdmann, J. F. Acute Diverticulitis of Colon	XII	96
Evers, F. C. Significance of Albuminuria	XXII	8
Ewing, James. Chances of Death from Carcinoma	XIII	50
Ewing, M. E., Blatherwick. Field Glucose Tolerance Tests	XIX	254
Exton, W. G. Albumin: Simple, Rapid Test for	VIII, 188; IX	263
Clinical Laboratory Measurements; Electro-Scopometry	XVII	292
Euscopy	VII	290
Preliminary Communication, Glycosuria	IX	258
Prudential Longevity Service	X	244
Quantitative Microscopic Urinalysis	XV	146
Some Incidentals of Urinalysis	VII	292
The Scopometer	XIII, 109; XVI	141
Diabetes and Life Insurance	VIII	105
Diagnosis of Diabetes	XX	49
Glycosuria	X	226
Impaired Lives	XII	90
Intermittent Glycosuria	XV	138
Metropolitan Laboratories	X	120
Sugar in Urine and Methods of Detection	VII	334
Exton, W. G., Rose. Alimentary Dextrose Tolerance Test	XXI	254
Determination of Hemoglobin in Selection	XX	215
Diabetes as Selection Problem	XVIII	252
Proteinuria and Glycosuria	XVI	143
Exton, W. G., Rose, Roehl. Glucose, Other Sugars, Reducing Substances	XXII	288
Exton, W. G., Rose, Schattner. Turbidity Micro for Blood Sugar	XVI	178
Exton, W. G., Rose, Wells. Quantitative Test, Sugar in Urine	XIV	441

	Volume	Page
Fellows, H. H. Electrocardiogram, X-ray and Ordinary Issue	XVIII	202
Handling X-ray and Electrocardiographic Examinations	XIX	15
Medical Aspects Gastro-Intestinal Diseases	XVI	263
Tuberculosis Patients Metropolitan Sanatorium	XV	276
X-ray in Evaluation Pulmonary Lesions	XXI	247
Ferguson, John. Disability Benefits for Women	XV	302
Epilepsy in Life Insurance	IX	87
Finney, J. M. T. Surgery Digestive Organs	XVI	203
Fisher, J. W. Alcoholic Stimulants, Experience Northwestern	IX	273
Goitre	XV	58
Mortality Miscellaneous Impairments	XIII	78
Mortality Non-Organic Systolic Heart Murmurs	XX	160
Policyholders Carrying Large Amounts	XVII	173
Report, Committee on Blood Pressure	VII	17
Blood Pressure Healthy Men and Women	IX	82
Epilepsy	IX	114
Gall Bladder Patient, Prognosis	XIII	169
Impaired Lives	XIII	186
Influenza	VI	58
Interpretation of Blood Pressure	XIX	136
Medical Directors	X	142
Overweights	VI	216
Selection Medical Examiners	X	279
Fisk, E. L. *Health Examinations*	XI	61
Work of Dreyer	VIII	216
Fitzgerald, Paul. *Group Insurance*	VII	178
Occupation and Mortality	VII	141
Folin, Otto. Distribution of Sugar Within Animal Body	XIV	428
Metropolitan Laboratories	X	111
Non-Protein Blood Nitrogen and Nephritis	XVII	319
Blood Tests	XVII	316
Diabetes	XVIII	278
Field Glucose Tolerance Tests	XIX	267
Glycosuria and Selection	XI	241
Intermittent Glycosuria	XV	115, 134
Folin, Otto; Blatherwick. Blood Sugar Curves After 50 Gms. Glucose	XVI	155
Foshay, P. M. Address of Welcome	XXIII	14
Disability Insurance	XII	284
Occupation and Mortality	VII	125

	Volume	Page
Fowler, R. S. *Gall Bladder Disease*	XXI	65
Fraser, F. R. Summary Goulstonian Lectures on Cardiac Dyspnoea	XVI	93
Fraser, R. A. Gassing and Shell Shock	VI	74
Presidential Address	XXI	8
Focal Infections	IX	155
Frost, H. M. Cardio-Respiratory Test x, 232; XII, 62; XIV, 183;	XVII	31
Cardio-Vascular Reaction to Intrathoracic Pressure	IX	207
Circulatory Impairments, Early Detection	XVIII	32
Cardiac Enlargement	XVIII	21
Disability Insurance	XIV	42
Flarimeter Tests	XVII	29
Functional Tests of Circulation	XVI	123
Impaired Lives	XIII	191
Mitral Insufficiency	XIII	210
Mitral Stenosis	XXII	175
Gage, Homer. *Appendicitis*	VII	276
Gaylord, H. R. Cancer	VIII	231
Geiringer, Arthur. *Health Examination*	XI	56
Gordon, A. H. *Diabetes*	XX	47
Gordon, J. K. *Urinary Analyses*	XIV	376
Gore, J. K. Address of Welcome	XVI	10
Overweights	VI	226
Graves, W. W. Scapular Types and Longevity	X	60
Grosvenor, F. L. Experience Border-Line Classifications	X	6
Group Insurance, Medical Aspects	VII	167
Mitral Insufficiency	XIII	199
Presidential Address	X	6
Cardio-Vascular-Renal Degeneration	XIV	282
Disability Benefit in Life Policies	XI	326
Interpretation Statistical Principles	XXIII	85
Medical Examiners for Life Insurance	XII	133
Mortality Southern States	XVII	220
Nervous or Mental Disease and Selection	XX	83
Non-Medical Mortality	XV	299

	Volume	Page
Hall, J. B. *Numerical Ratings*	VII	208
Hamilton, W. F. Gastro-Intestinal Tract Diseases	XVI	236
Impaired Lives	X	53
Impaired Risks, Canadian Companies	IX	253
Life Insurance Without Examination	XII	256
Hardin, J. R. Address of Welcome	XI	5
Harlow, G. A. First Year Death Claims	XVIII	115
Report on Goitre	VIII	265
Harnden, Frank. *Disability and Digestive Disorders*	XVI	298
Medical Relationships	XXII	250
Hart, T. S. Heart Murmurs and Irregularities	XI	107
Henderson, Robert. Relationship with Actuary	XV	35
Numerical Method of Selection	VI	134
Ratings Principal Impairments	VIII	138
Henderson, Robert; Rockwell. Mortality, History Tuberculosis	XIV	396
Henderson, Yandell. *Functional Tests of Circulation*	XVI	116
Hoare, D. W. Disability Insurance	XXII	75
Hobbs, A. B. Presidential Address	XIII	12
Study of Syphilis	XIII	14
Women as Life Insurance Risks	XVI	330
Hoffman, F. L. *Scapular Types and Longevity*	X	93
Homan, C. E., Jr. Pulmonary Tuberculosis, Changing Attitude	XXIII	94
Honsberger, J. F. Tuberculosis of Gastro-Intestinal Tract	XVI	270
Health Examinations	XI	94
Howk, H. J. *Disability, Mortality in Tuberculosis*	XII	187
Hunter, Arthur. Border-Line Risks	XVII	97
Medical Impairment Ratings	XX	123
Medical Impairment Study (1929)	XVIII	51
Weight and Blood Pressure: Average versus the Normal	VII	149
Hypertension as Underwriting Problem	XXI	230
Large Risk Underwriting	XVIII	114
Significance Systolic Murmur	XXI	150
Hunter, Arthur; Rogers. (See "Rogers, O. H., Hunter")		
Huston, Ross. Glycosuria and Selection	X	205
Lay Approvers	XI	145
Electrocardiogram, X-ray and Ordinary Issue	XVIII	210
Heart Problem of the Worker	XVII	83
Policyholders Insured for Large Amounts	XVII	190

	Volume	Page
Hutcheson, W. A. *Numerical Method of Selection*	VI	157
Hutchinson, J. P. *Surgery Digestive Organs*	XVI	230
Hutchinson, W. G. *Goitre*	XI	281
Ill, E. J. *Surgery Digestive Organs*	XVI	219
Jaquith, W. A. *Life Insurance Without Examination*	XVIII	153
Murmurs and Longevity	VI	202
Non-Medical Mortality	XV	293
Overweights	XII	49
Jenney, F. L. B. Epilepsy	IX	108
Jimenis, A. O. *Thyroid Disease*	XIX	242
Jimenis, A. O., Dublin, Marks. Gall Bladder Disease, Selection	XXI	34
Gastric or Duodenal Ulcer	XXII	24
Jimenis, A. O., Wilson. Electrocardiogram or X-ray and Underwriting	XXIII	18
Johann, A. E. Apical Cardiac Murmurs	XIV	155
Mitral Stenosis	XXII	178
Jones, F. L. Address of Welcome	XV	9
Joslin, E. P. Diabetes and Life Insurance	VIII	87
Diabetes Mellitus and Life Insurance	XXI	87
Kingsbury, F. B. Progress Quantitative Laboratory Method	XIV	383
Kingsbury, F. B., Clark. Demonstration Urinary Tests	XI	250
Kingsley, D. P. Address of Welcome	IX	6
Knight, A. S. Presidential Address	VIII	6
Weight, Over and Under Average; Mortality Ratios	IX	193
Border-Line Risks	XVII	115
Chances of Death from Carcinoma	XIII	61
Health Examinations	XI	51
Impaired Lives	X	54
Intermittent Glycosuria	XV	124
Juvenile Tuberculosis	XIV	335
Medical Impairment Study, 1929	XVIII	75
Numerical Method of Selection	VI	129

	Volume	Page
Knight, A. S., Dublin. Tuberculosis, Metropolitan Life Ins. Co. Sanatorium, 1914-27	XV	247
Koeppe, A. J., Muhlberg. Mortality Southern States	XVII	194
Kretschmer, H. L. Prostatic Obstruction and Life Insurance	XXII	183
Lahey, F. H. Thyroid Disease	XIX	228
Gastric or Duodenal Ulcer	XXII	63
Laird, J. M. *Disability Insurance*	XXII	113
Lambert, Alexander. Myocardial Degeneration, Coronary Thrombosis	XV	200
Larus, J. R. Interpretation Statistical Principles	XXIII	65
Life Insurance Without Examination	XVIII	149
Lee, L. H. Health Examinations	XXI	29
LeMoine, M. M., Rein. Syphilis and Life Insurance	XXI	13
LeMoine, M. M., Rein, Stephens. Life Insurance Companies and Syphilis	XXIII	145
Lindsey, L. S. Address of Welcome	XXI	10
Livingston, J. M. *Arterio-Sclerotic Heart*	XVIII	230
Blood Pressure, Heart Size; Body Area, and Metabolism	XX	250
Life Insurance Without Examination	XVIII	155
Mitral Stenosis	XXII	171
Lotka, A. J. *Law Small Chances and Selection*	XIX	186
Lounsberry, R. L. *Non-Medical Factors and Mortality*	XII	216
Low, E. I. Address of Welcome	XII	4
Lowsley, O. S. Urologic Surgery	XII	107
Prostatic Obstruction	XXII	198
McCall, J. C. Address of Welcome	XIII	76
McCarthy, Leighton. Address of Welcome	XX	4
McCloud, C. N. *Glycosuria*	X	219
McCord, C. P. Heart Problem of Worker	XVII	45
McCrudden, F. H. Glycosuria, Mortality Experience	XVII	333
Glycosuria, Proposed Method of Selection	XI	156
Diagnosis of Diabetes	XX	44
Laboratory Tests	XVI	196
Law of Small Chances and Selection	XIX	182
Murmurs and Irregularities	XI	123

	Volume	Page
McCulloch, C. B. *Aviation and Life Insurance*	XIV	151
Gassing and Shell Shock	VI	89
Life Insurance Without Examination	XII	255
MacDonald, A. A. *Medical Examiners and Companies*	XVII	283
Myocardial Degeneration	XV	235
MacEwen, D. C., Beckett. Disability Insurance	XIV	17
McKechnie, J. B. *Overweights*	VI	218
MacKenzie, L. F. *Blood Pressure Healthy Men and Women*	IX	70
Focal Infections	VII	238
Heart Problem of Worker	XVII	86
Murmurs and Irregularities	XI	125
MacKenzie, L. F., Dewis, Ylvisaker, Wells. Flarimeter Tests	XVII, 8; XVIII	239
Functional Tests of Circulation	XVI	36
MacKenzie, L. F., Patton. Pulse in Life Insurance	XIII	221
MacKenzie, L. F., Wells. Interpretation Blood Pressure	XIX	89
MacLean, J. B. *Interpretation Statistical Principles*	XXIII	78
McMahon, T. F. Presidential Address	IX	9
Overweights	VI	225
McPhedran, Maurice. X-ray and Evaluation Pulmonary Lesions	XXI	237
MacSweeney, E. S. Disability and Mortality Tuberculosis	XII	142
Mann, R. W. *Intermittent Glycosuria*	XV	107
Marks, H. H., Dublin. Pleurisy and Selection	XIX	203
Weight Standards, Mortality of Very Tall Men	XXIII	153
Marks, H. H., Dublin, Jimenis. Gall Bladder Disease, Selection	XXI	34
Gastric or Duodenal Ulcer and Selection	XXII	24
Martin, C. F. Pleurisy and Life Insurance	X	182
Focal Infections	VII	239
Gassing and Shell Shock	VI	87
Pulse in Life Insurance	XIII	282
Mathews, F. S. Gall Bladder Patient, Prognosis	XIII	139
Mead, F. B., *Murmurs and Longevity*	VI	211
Numerical Method of Selection	VI	162
Miller, J. A. Diagnosis Suspected Tuberculosis	XI	127

	Volume	Page
Milligan, Samuel. Large Risk Underwriting	XVIII	89
Milroy, W. F. *Medical Examiners for Life Insurance*	XII	137
Moir, Henry. Medical Directors and Executives	XV	42
Mosenthal, H. O. *Diabetes and Selection*	XVIII	273
Muhlberg, William. Conservation Work: Annual Urinalysis, Statement Health	VI	12
Presidential Address	XVII	6
Selection Medical Examiners	X	260
Survey Newer Chemical Urinary Tests	XIII	86
Blood Pressure, Interpretation of	XIX	144
Cancer and Overweight	XV	408
Cardio-Respiratory Test	XIV	238
Coronary Sclerosis and Insurance	XXI	169
Diabetes and Life Insurance	VIII	100
Disability and Digestive Disorders	XVI	302
Family History	XXII	155
Functional Tests of Circulation	XVI	129
Glycosuria	X	227
Heart Disease	XV	113
Impaired Lives	XIV	63
Intermittent Glycosuria	XV	113
Medical Examiners for Life Insurance	XII	133
Medical Impairment Ratings	XX	149
Pulmonary Tuberculosis, Changing Attitude	XXIII	121
Sugar in Animal Body	XIV	434
Urinary Analyses	XIV	379
Muhlberg, William; Behre. Acetone in Urine and Life Insurance	XVI	167
Muhlberg, William; Koeppe. Mortality Southern States	XVII	194
Murphy, R. D. *Occupation and Mortality*	VII	132
Neal, J. R. Chairman, American Life Convention, Med. Sect.	XX	6
Nichols, C. F. Cardiac Hypertrophy	XIX	35
Electrocardiogram or X-ray and Underwriting	XXIII	26
Overweights	VI	229
Nichols, C. F., Turner, Ungerleider. Determination Cardiac Enlargement	XX	184

	Volume	Page
Old, Herbert. Attitude Medical Examiners Toward Insurance Companies	XVII	245
Abnormal Pulse	XV	225
Asthma, Mortality of	XX	206
Cardiography, Oscillometry and Selection	XVI	31
Electrocardiography and Underwriting	XVIII	189
Myocardial Degeneration	XV	225
X-ray in Evaluation Pulmonary Lesions	XXI	243
Olsen, M. I. *Disability Benefits*	XV	369
Early Detection Circulatory Impairments, etc	XVIII	40
Ordway, W. H. *Tuberculosis: Insurance Viewpoint, Metropolitan Sanatorium*	XV	269
Pardee, H. E. B. Electrocardiogram and Life Insurance	XX	164
Parker, J. G. *Medical Impairment Ratings*	XX	155
Patton, J. A. Life Insurance Selection and Presidential Address	XVI	11
Urinary Impairments, Committee Report	XI, 244; XII, 115; XIII, 34;	XIV 12
Border-Line Risks	XVII	113
Cardio-Vascular-Renal Degeneration	XIV	283
Impaired Lives	XII	84
Impaired Risks, Canadian Companies	IX	256
Large Risk Underwriting	XVIII	109
Non-Medical Life Insurance	XVIII	142
Non-Medical Mortality	XV	296
Public Health	VII	82
Scapular Types and Longevity	X	96
Selection by Methods Other Than Numerical Rating	VII	204
Patton, J. A., MacKenzie. Pulse in Life Insurance	XIII	221
Paul, G. P. Disability Benefits	XV	354
Pauli, W. O. *Albumin in Urine; Glycosuria*	IX	271
Health Examinations	XI	53
Sugar in Urine, Methods of Detection	VII	325
Peabody, C. A. Address of Welcome	VII	4
Piper, C. B. *Chest, Abdominal Measurements; Height, Weight*	XVI	362
Family History	XXII	159
Life Insurance Without Examination	XII	247

	Volume	Page
Pollard, J. E. *Goitre*	XI	287
Insurance Record and Selection	XIII	73
Malignant and Benign Tumors	XXIII	221
Porter, W. E. *Female Risks With Pelvic Operations*	VI	48
Focal Infections	VII	232
Rabinowitch, I. M. Diagnosis of Diabetes	XX	9
Reiley, A. D. Disability Benefits	XIII	287
Rein, C. R. Kline Precipitation Test and Syphilis	XIX	275
Rein, C. R., LeMoine. Syphilis and Life Insurance	XXI	13
Rein, C. R., LeMoine, Stephens. Life Insurance Companies and Syphilis	XXIII	145
Rhodes, E. E. Non-Medical Thoughts Regarding Selection	XI	262
Numerical Method of Selection	VI	151
Righter, F. P. *Mortality Southern States*	XVII	236
Robinson, A. J. *Blood Tests*	XVII	331
Medical Relationships	XXII	258
Rockwell, T. H. Insurance Record and Selection	XIII	67
Mitral Regurgitation	IX	173
Presidential Address	VI	4
Diagnostic Value of Blood Pressure	VII	24
Disability Insurance	XIV	41
Glycosuria and Selection	XI	242
Non-Medical Mortality	XV	286
Ratings Principal Impairments	VIII	138
Rockwell, T. H., Henderson. Tuberculosis and Mortality	XIV	396
Roehl, E. J., Exton, Rose. Glucose, Other Sugars, Reducing Substances	XXII	288
Roesler, Hugo. *Cardiac Hypertrophy*	XIX	55
Rogers, O. H. Graphic Standard Table	XIII	44
Medical Selection: Past and Future	XVII	89
Relationships of Medical Directors, General	XV	49
Resolution: New Mortality Investigation	XV	53
Resolution: Preparation Mortality Ratings	XV	55
Abnormal Pulse	XV	222
Cardio-Respiratory Test	XIV	234
Diabetes and Life Insurance	VIII	117

	Volume	Page
Rogers, O. H.—Continued:		
Diagnostic Value of Blood Pressure	VII	25
Disability Insurance	XIV	42
Functional Tests of Circulation	XVI	114
Myocardial Degeneration	XV	222
Overweights	XII	57
Scapular Types and Longevity	X	99
Selection by Methods Other Than Numerical Rating	VII	198
Syphilis	XIII	43
Tuberculosis and Mortality	XIV	406
(See Photograph, XIX, viii)		
Rogers, O. H., Hunter. Blood Pressure and Sex, Weight, Climate, etc.	VI	92
Heart Murmurs and Longevity	VI	173
Mortality Study Impaired Lives (See "Impaired Lives")		
Numerical Method of Selection	VI	99
Occupation and Mortality	VII	88
Ratings for Principal Impairments	VIII	121
Rollins, H. B. *Attitude Medical Examiners*	XVII	285
Tuberculosis from Insurance Viewpoint	XV	275
Rolph, F. W. *Glycosuria and Selection*	XI	234
Root, E. K. *Disability Benefit in Life Policies*	XI	334
Disability Insurance	XIV	40
Group Insurance	VII	177
Murmurs and Irregularities	XI	120
Overweights	VI	222
Rose, A. R., Exton. (See "Exton, W. G., Rose")		
Rose, A. R., Exton, Roehl. Glucose, Other Sugars, Reducing Substances	XXII	288
Rose, A. R., Exton, Schattner. Turbidity Micro Method for Blood Sugar	XVI	178
Rose, A. R., Exton, Wells. Quantitative Test, Sugar in Urine	XIV	436
Rosenau, M. J. Influenza: Report Commission Metropolitan Life Ins. Co	VIII	62
Rowley, R. L. Effects of Appendicitis	VII	263
Epidemic Encephalitis	XVII	126
Presidential Address	XVIII	12
Cancer	VIII	264
Gall Bladder Patient, Prognosis	XIII	160
Influenza	VI	66
Life Insurance Without Examination	XII	243

	Volume	Page
Russell, E. F. Presidential Address	XXIII	12
Gastro-Intestinal Disease	XVI	258
Goitre	XI	292
Impaired Lives	IX	179
Medical Examiners for Life Insurance	XII	135
Scadding, H. C. Goitre, Remarks on	VIII	269
Impaired Risks, Action Canadian Companies	IX	229
Life Insurance Without Medical Examination	XII	223
Mortality, Male Lives, Without Medical Examination	XV	281
Presidential Address	XX	7
Policyholders Insured for Large Amounts	XVII	181
Tuberculosis and Mortality	XIV	410
Schattner, F., Rose, Exton. Turbidity Micro Method for Blood Sugar	XVI	178
Scholz, S. B., Jr. *Epigastric Pain*	XX	117
Women as Insurance Risks	XVI	334
Schwartz, B. A. Flarimeter Tests in Heart Clinic	XVI	132
Schwarz, B. T. D. Medical Relationships	XXII	248
Scott, R. W. Significance Systolic Murmur	XXI	114
Sheppard, H. N. *Numerical Method of Selection*	VI	167
Shewbrooks, D. M. *Albuminuria*	XXII	17
Simmons, R. R. *Medical Relationships*	XXII	247
Smith, J. M. *Aviation and Life Insurance*	XIV	145
Smith, W. B. *Human Element in Aviation*	XVII	163
Smith, W. B., Sykes. Aviation and Life Insurance	XIV	74
Snow, Morton. *Appendicitis*	VII	282
Disability Benefit in Life Policies	XI	336
Policyholders Insured for Large Amounts	XVII	178
Starr, R. S. *Electrocardiography and Underwriting*	XVIII	191
Steel, David. *Cardiac Hypertrophy*	XIX	62
Stephens, M. G., Rein, LeMoine. Life Insurance Companies and Syphilis	XXIII	145
Stillman, R. G. *Syphilis and Life Insurance*	XXI	23

	Volume	Page
Strathy, G. S. Impairments from Military Service	VI	250
Military Service and Insurance	VII	244
Gassing and Shell Shock	VI	83
Glycosuria	X	221
Selection Medical Examiners	X	280
Streight, S. J. Chairman, American Life Convention, Med. Sect.	XXII	6
Non-Diabetic Glycosuria and Life Insurance	XV	79
Hypertension and Selection	XXI	210
Strong, W. M. *New General Code of Impairments*	XIX	197
Strong, W. M., Weisse. Overweights, Selection and Statistics	XII	24
Women as Insurance Risks	XVI	307
Sykes, L. G. Human Element in Aviation	XVII	144
Relationship with Examiners	XV	17
Disability Insurance	XII	289
Murmurs and Irregularities	XI	122
Sykes, L. G., Smith. Aviation and Life Insurance	XIV	74
Symonds, Brandreth. Blood Pressure Healthy Men and Women	IX	22
Value Medical Examiner's Opinion	VII	29
Albuminuria and Casts	VIII	302
Impaired Lives	IX	181
Influenza	VI, 69; VIII	81
Medical Directors	X	140
Numerical Method of Selection	VI	142
Overweights	VI	226
Public Health	VII	81
Selection by Methods Other Than Numerical Rating	VII	202
Taylor, H. F. *Electrocardiogram in Life Insurance*	XX	180
Electrocardiogram, X-ray and Underwriting	XXIII	24
Electrocardiography and Underwriting	XVIII	165
Thompson, J. S. Chest, Abdominal Measurements: Height, Weight	XVI	352
Mortality from Build Using Index W/H2	XXIII	57
Thorndike, William. *Overweights*	XII	47
Thornton, W. E. Medical Relationships of Life Insurance	XXII	224
Timme, Walter. *Weight Standards, Mortality of Very Tall Men*	XXIII	184

	Volume	Page
Toulmin, Harry. Influenza, Recurrence of	VI	52
Periodic Health Examinations	XI	47
Appendicitis	VII	278
Chances of Death from Carcinoma	XIII	63
Diagnostic Value Blood Pressure	VII	25
Medical Examiners for Life Insurance	XII	136
Numerical Method of Selection	VI	155
Ratings Principal Impairments	VIII	153
Truitt, F. L. *Glycosuria*	X	215
Turner, H. B., Nichols, Ungerleider. Determination Cardiac Enlargement	XX	184
Turner, J. P. *Selection Medical Examiners*	X	278
Ungerleider, H. E. *Electrocardiogram, X-ray and Underwriting*	XXIII	40
Electrocardiography	XVIII	180
X-ray and Electrocardiographic Examinations	XIX	31
Ungerleider, H. E., Nichols, Turner. Determination Cardiac Enlargement	XX	184
Van Dervoort, C. A. *Disability Insurance*	XIV	34
Epidemic Encephalitis	XVII	139
Gastro-Intestinal Tuberculosis	XVI	280
Van Kleeck, Euen. *Insurance Record and Selection*	XIII	72
Van Wagenen, G. A. Reminiscences	XI	342
Overweights	VI	228
Ward, W. R. Pleurisy	X	200
Presidential Address	XI	16
Blood Pressure Healthy Men and Women	IX	79
Gastro-Intestinal Tuberculosis	XVI	278
Impaired Lives	XIV	67
Overweights	XII	45
Wehner, W. E. H. *Disability Benefits*	XV	394

	Volume	Page
Weisse, F. S. Presidential Address	VII	6
Appendicitis	VII	279
Impaired Lives	XIV	62
Influenza	VIII	83
Medical Impairment Study, 1929	XVIII	84
New Code of Impairments	XIX	201
Policyholders Insured for Large Amounts	XVII	185
Ratings Principal Impairments	VIII	158
Selection Medical Examiners	X	277
Syphilis	XIII	37
Tuberculosis and Mortality	XIV	419
Weisse, F. S., Strong. Overweights, Selection and Statistics	XII	24
Women as Life Insurance Risks	XVI	307
Welch, A. A. Address of Welcome	XVIII	12
Wells, F. C. *Conservation Work, Policyholders*	VI	25
Public Health	VII	82
Wells, F. L. Medical Examiners for Life Insurance	XII	121
Presidential Address	XXII	6
Disability Benefits	XV	381
Group Insurance	VII	174
Wells, P. V. Law of Small Chances and Selection	XIX	155
Wells, P. V., Exton, Rose. Quantitative Test for Sugar in Urine	XIV	436
Wells, P. V., MacKenzie. Interpretation of Blood Pressure	XIX	89
Wells, P. V., MacKenzie, Dewis, Ylvisaker. Flarimeter Tests	XVII, 8; XVIII	239
Functional Tests of Circulation	XVI	36
Wenstrand, D. E. W. Family History	XXII	139
Apical Cardiac Murmurs	XIV	173
Gastro-Intestinal Diseases	XVI	253
Interpretation of Blood Pressure	XIX	136
White, P. D. *Electrocardiogram, X-ray and Ordinary Issue*	XVIII	212
Electrocardiography and Underwriting	XVIII	193
Whitney, C. F. S. Presidential Address	XII	17
Gassing and Shell Shock	VI	90
Willard, T. H. General Education in Public Health	VII	73
Response to "Past and Future of Medical Selection"	XVII	93
Conservation Work, Policyholders	VI	22
Group Insurance	VII	172
Influenza	VIII	84
Medical Directors	X	138

	Volume	Page
Wilson, E. W. Jimenis. Electrocardiogram, X-ray and Underwriting	XXIII	18
Wilson, Gordon. Abnormal Pulse	XV	192
Cardiac Enlargement	XVIII	14
Apical Cardiac Murmurs	XIV	168
Cardio-Vascular-Renal Degeneration	XIV	290
Disability, Mortality in Tuberculosis	XII	193
Flarimeter Tests	XVII	26
Focal Infections	IX, 157; VII	235
Impaired Lives	XIV	70
Juvenile Tuberculosis	XIV	340
Large Risk Underwriting	XVIII	112
Medical Examiners for Life Insurance	XII	137
Myocardial Degeneration	XV	230
Pleurisy	X	199
Wilson, McL. C. *Disability and Digestive Disorders*	XVI	294
Disability Insurance	XXII	131
Wishard, E. E. *Pulse in Life Insurance*	XIII	276
Wolf, A. S. Detection of Sugar in Urine	VII	316
Intermittent Glycosuria	XV	124
Wood, F. C. Malignant and Benign Tumors	XXIII	208
Wood, W. A. P. *Overweights*	VI	222
Woodward, J. H. *Murmurs and Longevity*	VI	198
Ylvisaker, L. S. *Pulmonary Tuberculosis, Changing Attitude*	XXIII	101
Ylvisaker, L. S., Dewis, MacKenzie, Wells. Flarimeter Tests	XVII, 8; XVIII	239
Functional Tests of Circulation	XVI	36

Subject Index

1920-1936

NOTE—The Names of Authors are Printed in Plain Type; of Discussers, in *Italics*.

	Volume	Page
Abdominal, Chest Measurements: Related to Height, Weight. Thompson, XVI, 352; Clark, XVI, 341. *Weisse, Piper.*		
Acetone, Urinary and Life Insurance Examinations. Behre, Muhlberg. *Benedict, Cort, Brown*	XVI	167
Actuaries and Medical Directors. Henderson	XV	35
Address: Presidential. Rockwell, VI, 4; Weisse, VII, 6; Knight, VIII, 6; McMahon, IX, 9; Grosvenor, X, 6; Ward, XI, 16; Whitney, XII, 17; Hobbs, XIII, 12; Beckett, XIV, 6; Daley, XV, 12; Patton, XVI, 11; Muhlberg, XVII, 6; Rowley, XVIII, 12; Christiernin, XIX, 14; Scadding, XX, 7; Fraser, XXI, 8; Wells, XXII, 6; Russell, XXIII, 12.		
Address: Of Welcome. Peabody, VII, 4; Ecker, VIII, 5; Kingsley, IX, 6; Hardin, XI, 5; Low, XII, 4; McCall, XIII, 76; Jones, XV, 9; Welch, XVIII, 12; McCarthy, XX, 4; Lindsey, XXI, 10; Foshay, XXIII, 14.		
Albuminuria:		
A Visual Guide to. Cook	IX	277
Mortality. Rogers, Hunter	XII	71
Significance of. Evers. *Bradshaw, Shewbrooks*	XXII	8
Simple and Rapid Test. Exton. *Blakely, Pauli, Bradshaw*	VIII, 188; IX	263
Albuminuria and Casts. Russell. *Daley, Dwight, Symonds*	VIII	270
Alcohol, as Affecting Blood Pressure, etc. Hunter, Rogers	VI	92
Alcoholic Stimulants, Experience Northwestern. Fisher	IX	273
Altitude, as Affecting Blood Pressure, etc. Hunter, Rogers	VI	92
Amendments:		
Constitutional. Article III—X, 39; Article VIII—X, 38; Article XII	VIII	61
Payment of Dues	XVI	10
Report on	XIII	37
To By-Laws	VI	10

	Volume	Page
American Heart Association	XVI	31
Anthropometrical Supplement: Dreyer's Work. Dublin	X	162
Apical Cardiac Murmurs. Johann. *Wilson, Wenstrand*	XIV	155
Appendicitis:		
Mortality Rates	XVI	254
Some Effects of. Rowley. *Gage, Toulmin, Weisse, Dwight, Beckett, Snow*	VII	263
Applicant Not Robust, etc.: Mortality. Rogers, Hunter	X	43
Arterio-Sclerotic Heart. Birchard. *Livingston, Chapin*	XVIII	217
Assessment, Report of Committee. Christiernin	XI	26
Association and Medical Directors. Daley	XV	46
Association of Medical Directors. (See "Members", "Officers")		
Asthma, Mortality. Dublin, Marks. *Old, Caulfeild*	XX	191
Aviation:		
And Life Insurance. Sykes, Smith. *Bartlett, McCulloch, Smith*	XIV	74
Human Element in. Sykes. *Chambers, Bartlett, Smith*	XVII	144
Service, French	XVI	48
Biliary Colic: (See "Gall Bladder")		
And Gall Stones, Mortality. Hamilton	XVI	254
Mortality Study, Impaired Lives, No. 7. Rogers, Hunter	XV	412
Mortality Tables	XVI	254
Results of Treatment	XVI	286
Blood, Non-Protein Nitrogen and Nephritis. Folin. *Cort, Benedict, Robinson, Exton, Blatherwick*	XVII	319
Blood Pressure: (See "Hypertension")		
As Affected by Sex, Weight, Climate, Altitude, Latitude, Abstinence from Alcoholic Beverages. Hunter, Rogers	VI	92
Committee on	VIII, 38;	IX 59
Diagnostic Value. Fisher. *Rogers, Rockwell, Toulmin*	VII	17
Diastolic, Reaction to Cardio-Respiratory Test. Amiral. *Rogers, Muhlberg*	XIV	219
Diastolic, Report on. Bailey	XI	143
Healthy Men and Women. Symonds. *MacKenzie, Ward, Fisher*	IX	22
High: Mortality. Rogers, Hunter	X	43
Interpretation of. MacKenzie, Wells. *Wenstrand, Fisher, Muhlberg, Bassford*	XIX	89
Mortality and Reported Diastolic Readings. Bassford	XIX	77

	Volume	Page
Blood Pressure: (See "Hypertension")—Continued:		
Over Average for Age, Mortality. Rogers, Hunter	XIII	176
Practical Observations on Taking. Crawford	XI	38
Relation to Heart Size, Body Surface Area and Metabolism. Clark. *Cook, Livingston*	XX	224
Blood Sugar:		
And Urinary After 50 Grams Cane Sugar. Blatherwick. *Cort, Benedict, Robinson, Exton, Folin*	XVII	310
Curves After 50 Grams Glucose. Folin, Blatherwick	XVI	155
Field Glucose Tolerance Tests. Blatherwick, Ewing. *Folin, Cort*	XIX	254
Mortality, Glycosuria: Normal Blood Sugar Test. McCrudden	XVII	333
Turbidity Micro Method for. Rose, Schattner, Exton. *Benedict, Cort, Brown*	XVI	178
Border-Line Classifications, Experience. Grosvenor	X	6
Border-Line Risks. Hunter. *Patton, Knight, Rockwell*	XVII	97
Breath-Holding Test: "Pressprobe", British Royal Air Force	XVI	48
Build and Mortality, Using Index W/H_2. Clark. *Thompson*	XXIII	46
By-Laws and Constitution, Committee on Revision of	X	38
Cancer:		
Address on. Gaylord. *Cook, Rowley*	VIII	231
Chances of Death from. Ewing. *Knight, Toulmin*	XIII	50
In Relation to Overweight. Dublin. *Muhlberg*	XV	402
Malignant and Benign Tumors. Wood. *Pollard*	XXIII	208
Of Stomach. Hamilton	XVI	241
Carcinoma, Chances of Death. Ewing. *Knight, Toulmin*	XIII	50
Cardiac: (See "Heart")		
Dyspnoea. Fraser's Goulstonian Lectures	XVI	93
Enlargement. Turner, Nichols, Ungerleider	XX	184
Enlargement; Visibility Apex Beat. Wilson. *Frost, Cook, Bradshaw*	XVIII	14
Functional Tests. Dwight	IX	203
Hypertrophy. Nichols. *Roesler, Steel*	XIX	35
Cardiography, Oscillometry and Selection. Brathwaite. *Old, Cragin*	XVI	19
Cardio-Respiratory Test. Frost. *Dwight, Rogers, Muhlberg*	XII, 62; XIV, 183; XVI, 123;	XVII 31

	Volume	Page
Cardio-Vascular Reaction to Variations of Intra-Thoracic Pressure. Frost. *Exton, Symonds, Pauli, Wilson, Porter, Archibald, Rogers*	IX	207
Cardio-Vascular-Renal Degeneration. Cook. *Grosvenor, Patton, Wilson*	XIV	250
Casts and Albuminuria. Russell. *Daley, Dwight, Symonds*	VIII	270
Chest, Abdominal Measurements: Related to Height, Weight. Thompson, XVI, 352; Clark, XVI, 341. *Weisse, Piper.*		
Circulation: (See "Heart", "Functional Tests")		
Functional Tests of. MacKenzie, Wells, Dewis, Ylvisaker. *Rogers, Henderson, Frost, Muhlberg, Cook*	XVI	36
Impairments, Early Detection and Significance. Frost. *Olsen, Clark, Wilson*	XVIII	32
Climate, as Affecting Blood Pressure, etc. Hunter, Rogers	VI	92
Colitis. Hamilton	XVI	246
Colon. Diverticulitis of, Acute. Erdmann	XII	96
Colorimeter, The. Cragin	XIII	194
Companies Belonging to Association. (See "Members")		
Conservation Work, Annual Urinalysis, Policyholders' Statements of Health. Muhlberg. *Willard, Wells*	VI	12
Constitution and By-Laws, Committee on Revision of	X	38
Coronary Sclerosis and Insurance. Barnes. *Cook, Muhlberg, Baker, Bartlett*	XXI	154
Death Claims, First Year. Harlow	XVIII	115
Death of Insured Persons: Committee on Informing Hospitals and Physicians	VII, 243; VIII	59
Development and Decay, Tempo of. Boas. *Dublin, Alvarez*	XXII	212
Dextrose Tolerance Test, A New Alimentary. Exton, Rose	XXI	254
Diabetes: (See "Glycosuria", "Blood Sugar")		
And Life Insurance. Joslin. *Muhlberg, Exton, Balch, Rogers*	VIII	87
And Selection. Exton, Rose. *Mosenthal, Folin, Blatherwick, Blakely*	XVIII	252
Diabetes. Daley	XV	76
Diagnosis of. Rabinowitch. *McCrudden, Gordon, Exton*	XX	9
Mellitus and Life Insurance. Dillon. *Joslin, Cragin*	XXI	96
Diastolic Blood Pressure. Bailey	XI	143
Diastolic Pressure: Reaction to Cardio-Respiratory Test. Amiral. *Rogers, Muhlberg*	XIV	219

	Volume	Page
Digestive Disorders and Disability. Dingman. *Wilson, Harnden, Sykes, Muhlberg*	XVI	285
Digestive Organs, Surgery of. Finney. *Ill, Cragin, Hutchinson*	XVI	203
Disability Benefits:		
Disability Benefits. Paul. *Olsen, Wells, Wehner*	XV	354
For Women. Ferguson	XV	302
From Underwriting Standpoint. Reiley	XIII	287
In Life Policies. Craig. *Beckett, Grosvenor, Root, Snow*	XI	294
Disability Claims: Tables	XVI	296
Disability and Digestive Disorders. Dingman. *Wilson, Harnden, Sykes, Muhlberg*	XVI	285
Disability Insurance:		
Beckett, MacEwen. *Van Dervoort, Root, Rockwell, Frost, Rogers*	XIV	17
Dingman. *Foshay, Sykes*	XII	263
Hoare. *Laird, Dechert, Wilson, Alvarez*	XXII	75
Disability, Mortality in Arrested Tuberculosis. MacSweeney. *Howk, Wilson*	XII	142
Diverticulitis of the Colon, Acute. Erdmann	XII	96
Doctor and Insurance. Dingman	XIV	295
Dreyer, Work of:		
And Life Insurance. Dublin. *Fisk*	VIII	202
Anthropometrical Supplement to Report on. Dublin	X	162
Committee to Study	VIII, 309; X	147
Measurements, 1925 Committee Report. Dublin	XII	204
Measurements and Underwriting: 1924 Committee Report. Dublin	XI	28
Report of Committee	IX	20
Duodenal Ulcer. (See "Gastric Ulcer")		
Dyspnoea, Cardiac. Fraser's Goulstonian Lectures	XVI	93
Electrocardiogram:		
And X-ray, Procedure. Fellows. *Birchard, Ungerleider*	XIX	15
Theory and Application. Pardee. *Birchard, Taylor*	XX	164
X-ray and Ordinary Issue. Fellows. *Cragin, Huston, White*	XVIII	202
X-ray and Underwriting. Jimenis, Wilson. *Taylor, Nichols, Ungerleider*	XXIII	18

	Volume	Page
Electrocardiography:		
And Underwriting. Taylor. *Ungerleider, Old, Starr, White*	XVIII	165
Oscillometry and Selection. Brathwaite. *Old*	XVI	19
Electro-Scopometry, Preliminary Note. Exton	XVII	301
Encephalitis, Epidemic. Rowley. *Bradshaw, Dingman, Van Dervoort*	XVII	126
Epigastric Pain, Significance of. Eads. *Scholz*	XX	103
Epilepsy and Life Insurance. Ferguson. *Jenney, English, Fisher*	IX	87
Euscopy. Exton	VII	290
Examiners, Examinations. (See "Medical Examiners.")		
Executives and Medical Directors. Moir	XV	42
Exercise Tests	XVI	51
Family History:		
And Mortality; Joint Medico-Actuarial Committee	VIII	56
Family History. Wenstrand. *Muhlberg, Piper*	XXII	139
Female Risks, With Pelvic Operations: Selection and Mortality. Brown. *Beckett, Porter*	VI	31
Flarimeter Test:		
Flarimeter Test. MacKenzie, Wells, Dewis, Ylvisaker. *Wilson, Frost, Bradshaw* XVII, 8;	XVIII	239
In Heart Clinic. Schwartz	XVI	132
Fluoroscope in Life Insurance Examination	XVI	267
Focal Infections and Life Insurance:		
Anderson. *Fraser, Wilson*	IX	144
Bradshaw. *Porter, Wilson, MacKenzie, Martin, Chapin*	VII	222
Functional Murmurs, Mortality. Rogers, Hunter	XI	96
Functional Tests of Circulation. MacKenzie, Wells, Dewis, Ylvisaker. *Rogers, Henderson, Frost, Muhlberg, Cook* (See also "Breath-Holding Test", "Cardio-Respiratory Test", "Cardio-Vascular", "Flarimeter Test")	XVI	36
Gall Bladder: (See "Biliary Colic")		
Disease. Dublin, Jimenis, Marks. *Fowler, Crohn*	XXI	34
Disease. Hamilton	XVI	248
Infection, Liver and Pancreas in. Hamilton	XVI	250
Patient, Prognosis. Mathews. *Rowley, Fisher*	XIII	139

	Volume	Page
Gall Stones and Biliary Colic, Mortality. Hamilton, XVI, 254; Rogers, Hunter, XV, 412.		
Gassing and Shell Shock. Fraser. *Strathy, Archibald, Martin, Anderson, McCulloch, Whitney*	VI	74
Gastric and Duodenal Ulcer:	XVI	220
Mortality on Substandard and Underwriting	XVI	227
Operative Mortality Rate	XVI	218
Relation to Cancer Stomach	XVI	241
Results of Treatment	XVI	287
Selection. Dublin, Jimenis, Marks. *Alvarez, Lahey*	XXII	24
Study 510 Cases, Johns Hopkins and Union Memorial	XVI	209
Gastro-Intestinal Disease:		
Incidence General Population	XVI	265
Medical Aspects. Hamilton. *Wenstrand, Russell, Fellows* (See "Appendicitis", "Colitis", "Digestive", "Diverticulitis", "Gastric Ulcer", "Stomach")	XVI	236
Glucose, Other Urinary Sugars and Reducing Substances. Exton, Rose, Roehl	XXII	288
Glucose Tolerance Tests. Blatherwick, Ewing. *Folin, Cort*	XIX	254
Glycosuria:		
Advantages Rate of Excretion over Concentration. Exton, Rose. *Benedict, Cort, Brown, McCrudden*	XVI	143
Charts. Brathwaite	XV	100
Importance in Selection. Huston. *Truitt, McCloud, Strathy, Daley, Exton, Muhlberg, Brown*	X	205
Intermittent, Clinical Significance of. Bradshaw, Carber. *Mann, Muhlberg, Folin, Wolf, Knight, Shewbrooks, Cort, Dillon, Exton, Streight*	XV	66
Low Threshold and Other Non-Diabetic Types. Streight	XV	79
Method of Estimating. Exton. *Blakely, Pauli, Bradshaw*	IX	258
Mortality. Rogers, Hunter	XII	71
Mortality Experience. McCrudden	XVII	333
Occasional Slight, Proposed Method of Selection. McCrudden. *Benedict, Rolph, Bradshaw, Dwight, Folin, Rockwell*	XI	156
Selective Formula, Mortality. Brathwaite. *Cragin*	XX	52
Goitre:		
Goitre. Fisher	XV	58
Present Status. Carber. *Hutchinson, Bradshaw, Pollard, Russell*	XI	270

	Volume	Page
Goitre—Continued:		
Remarks on. Scadding	VIII	269
Report Joint Committee	XII	20
Report on. Harlow	VIII	265
Thyroid Disease. Lahey. *Jimenis*	XIX	228
Graphic Standard Table. Rogers	XIII	44
Group Insurance, Medical Aspects. Grosvenor. *Willard, Wells, Root, Fitzgerald, Cook*	VII	167
Health Examinations:		
For Policyholders. Toulmin. *Knight, Pauli, Geiringer, Fisk, Honsberger*	XI	47
Study of. Lee	XXI	29
Heart:		
Abnormal Pulse. Wilson. *Cook, Rogers, Old, Cragin*	XV	192
Apical Cardiac Murmurs. Johann. *Wilson, Wenstrand*	XIV	155
Arterio-Sclerotic Heart. Birchard. *Livingston, Chapin*	XVIII	217
Cardiac Functional Tests. Dwight	IX	203
Coronary Sclerosis as an Insurance Problem. Barnes. *Cook, Muhlberg, Baker, Bartlett*	XXI	154
Enlargement. Turner, Nichols, Ungerleider	XX	184
Enlargement. Wilson. *Frost, Cook, Bradshaw*	XVIII	14
Fibrillation, Ventricular. Henderson	XVI	117
Hypertrophy. Nichols. *Roesler, Steel*	XIX	35
Mitral Regurgitation. Rockwell	IX	173
Murmurs and Irregularities. Hart. *Root, Sykes, Baker, McCrudden, MacKenzie*	XI	107
Murmurs and Longevity. Rogers, Hunter. *Dwight, Woodward, Jaquith*	VI	173
Murmurs, Functional, Mortality. Rogers, Hunter	XI	96
Murmurs, Non-Organic: Mortality. Fisher	XX	160
Murmurs, Systolic: Significance. Scott. *Campbell, Hunter*	XXI	114
Myocardial Degeneration and Coronary Thrombosis. Lambert. *Cook, Rogers, Old, Wilson, Cragin, MacDonald*	XV	200
Problem of the Worker. McCord. *Cook, Brathwaite, Huston, MacKenzie*	XVII	45
(See "Blood Pressure", "Cardiac", "Cardio-Respiratory", "Cardio-Vascular", "Circulation", "Electrocardiogram", "Flarimeter Tests", "Mitral", "Pulse")		
Height, Weight: Related to Abdominal, Chest Measurements. Thompson, XVI, 352; Clark, XVI, 341. *Weisse, Piper.*		

	Volume	Page
Heights: Study of Average Weights for Heights. Clark	XXII	266
Hemoglobin and Selection. Exton, Rose	XX	215
Hypertension and Underwriting. Bolt. *Streight, Bassford, Hunter*	XXI	183
(See "Blood Pressure")		
Hypertrophy, Cardiac. Nichols. *Roesler, Steel*	XIX	35
Impaired Lives, Mortality Study. Rogers, Hunter:		
Albuminuria; Glycosuria. *Patton, Bradshaw, Exton, Clark.* (No. 4)	XII	71
Applicant not Robust, Pale, etc.; High Blood Pressure. *Brown, Hamilton, Knight.* (No. 2)	X	43
Blood Pressures Over Average for Age. *Fisher, Eakins, Frost.* (No. 5)	XIII	176
Heart Murmurs, Mitral Regurgitation; Functional Murmurs. (No. 3)	XI	96
Inflammatory Rheumatism; Tuberculosis Lungs, Blood Spitting. *Russell, Symonds, Eakins, Chapin.* (No. 1)	IX	161
Intermittent, Irregular Pulse; Rapid Pulse. *Weisse, Muhlberg, Ward, Wilson.* (No. 6)	XIV	54
Renal Colic, Calculus, Gravel; Biliary Colic, Gall Stones (No. 7)	XV	412
Impaired Risks: Selection by Canadian Companies. Scadding. *Hamilton, Archibald, Patton*	IX	229
Impairment Study (1929). Hunter. *Knight, Campbell, Weisse*	XVIII	51
Impairments: (See "Medical Impairments")		
Circulatory: Early Detection, etc. Frost. *Olsen, Clark*	XVIII	32
From Military Service. Strathy	VI	250
Miscellaneous; Mortality. Fisher	XIII	78
New General Code. Carber. *Strong, Weisse*	XIX	188
Principal: Ratings for. (See "Ratings, etc.")		
Influenza:		
Likelihood of Recurrence. Toulmin. *Fisher, Rowley, Symonds, Anderson, Beckett*	VI	52
Report Commission Metropolitan Life Insurance Company. Rosenau. *Symonds, Weisse, Willard*	VIII	62
Insurance Record and Selection. Rockwell. *Van Kleeck, Pollard, Eakins, Fisher*	XIII	67
Kline Precipitation Test: Stillman	XXI	23
For Syphilis. Rein. *Chargin, Blaivas*	XIX	275

	Volume	Page
Laboratories, Metropolitan. Benedict, Folin. *Exton, Balch*	x	111
Laboratory Measurements and Electro-Scopometry. Exton	xvii	292
Laboratory Method, Quantitative. Kingsbury. *Clark*	xiv	383
Large Amounts, Policyholders Insured for. Fisher. *Snow, Scadding, Weisse, Huston*	xvii	173
Large Risk Underwriting. Milligan. *Cook, Patton, Wilson, Hunter*	xviii	89
Latitude, as Affecting Blood Pressure, etc. Hunter, Rogers	vi	92
Law Small Chances, Selection. Wells. *McCrudden, Lotka*	xix	155
Life Insurance:		
Companies and Syphilis. Rein, LeMoine, Stephens	xxiii	145
Selection. Patton	xvi	11
Without Medical Examination. Bartlett. *Baker, Patton, Larus, Jaquith, Livingston*	xviii	121
Without Medical Examination. Scadding. *Rowley, Piper, Archibald, McCulloch, Hamilton*	xii	223
(See "Non-Medical")		
Liver and Pancreas in Gall Bladder Infection. Hamilton	xvi	250
Longevity:		
In Relation to Scapular Types. Graves. *Dublin, Hoffman, Patton, Rogers*	x	60
Service, Prudential. Exton	x	244
Master and Oppenheimer's Table	xvi	59
Measurements: Abdominal, Chest as Related to Height, Weight. Thompson, xvi, 352; Clark, xvi, 341. *Weisse, Piper.*		
Medical Blank:		
Report of Committee to Review Questions	xii	18
Standardization of: Report of Committee	ix	21
Medical Directors: Eakins. *Willard, Symonds, Fisher*	x	128
Relationships of. Daley	xv	12
Relationships of, with Actuary. Henderson	xv	35
Relationships of, with Association. Daley	xv	46
Relationships of, with Each Other and in General. Rogers	xv	49
Relationships of, with Examiners. Sykes	xv	17
Relationships of, with Executives. Moir	xv	42
Medical Examination Blanks:		
Committee on	x	36
Standardization of. Dillard, Chapman	viii	169

	Volume	Page
Medical Examiners:		
Attitude Toward Insurance Companies. Old. *Sykes, Alton, MacDonald, Rollins*	XVII	245
Education and Listing of: Committee to Study	XV	190
For Life Insurance. Wells. *Beckett, Grosvenor, Muhlberg, Russell, Toulmin, Milroy, Wilson*	XII	121
Relationship with Medical Directors. Sykes	XV	17
Selection of. Muhlberg. *Weisse, Turner, Fisher, Strathy*	X	260
Situation, Committee to Make Survey of	X	43
Medical Impairments:		
Ratings. Hunter. *Muhlberg, Parker*	XX	123
Resolution New Investigation. Rogers	XV	53
Study (1929). Hunter. *Knight, Campbell, Weisse*	XVIII	51
Medical Relationships of Life Insurance. Thornton. *Cook, Simmons, Schwarz, Cragin, Robinson, Harnden, Eakins*	XXII	224
Medical Selection:		
Law of Small Chances in. Wells	XIX	155
Past and Future of. Rogers. *Response:—Willard*	XVII	89
With History Pleurisy. Dublin, Marks	XIX	203
Members of the Association:		
Active. VI, 257; VII, 361; VIII, 313; IX, 283; X, 287; XI, 347; XII, 294; XIII, 297; XIV, 445; XV, 427; XVI, 369; XVII, 355; XVIII, 287; XIX, 289; XX, 259; XXI, 283; XXII, 294; XXIII, 227.		
Companies and Representatives. VI, 264; VII, 369; VIII, 322; IX, 292; X, 297; XI, 359; XII, 307; XIII, 311; XIV, 460; XV, 442; XVI, 380; XVII, 367; XVIII, 299; XIX, 302; XX, 272; XXI, 296; XXII, 307; XXIII, 240.		
Deceased. (See "Obituaries") VI, 270; VII, 377; VIII, 331; IX, 303; X, 307; XI, 369; XII, 316; XIII, 321; XIV, 470; XV, 453; XVI, 389; XVII, 376; XVIII, 308; XIX, 312; XX, 282; XXI, 306; XXII, 317; XXIII, 250.		
Emeritus. XIV, 459; XV, 441; XVI, 379; XVII, 366; XVIII, 298; XIX, 301; XX, 271; XXI, 295; XXII, 306; XXIII, 239.		
Honorary. VI, 263; VII, 368; VIII, 321; IX, 291; X, 296; XI, 358; XII, 306; XIII, 310; XIV, 459; XV, 441; XVI, 379; XVII, 366; XVIII, 298; XIX, 301; XX, 271; XXI, 295; XXII, 306; XXIII, 239.		
Mental, Nervous Disease: Selection. Barker. *Grosvenor*	XX	76
Metropolitan Laboratories. Benedict, Folin. *Exton, Balch*	X	111

	Volume	Page
Military Service:		
And Life Insurance. Strathy	VII	244
Impairments from. Strathy	VI	250
"Mistakes". Eakins	XIV	46
Mitral Insufficiency. Grosvenor. *Cook, Frost*	XIII	199
Mitral Regurgitation: Rockwell	IX	173
Mortality. Rogers, Hunter	XI	96
Mitral Stenosis. Birchard. *Livingston, Frost, Johann*	XXII	165
Mortality:		
From Build Using Index W/H_2. Clark. *Thompson*	XXIII	46
Impaired Lives. Rogers, Hunter. (See "Impaired Lives, etc.")		
Impairments, Miscellaneous. Fisher	XIII	78
Weight Standards, Very Tall Men. Dublin, Marks	XXIII	153
(See "Appendicitis", "Applicant Not Robust", "Asthma", "Biliary Colic", "Blood Pressure", "Blood Sugar", "Border-Line Risks", "Death Claims", "Family History", "Gastric Ulcer", "Glycosuria", "Heart", "Impairments", "Non-Medical", "Occupation", "Overweights", "Pulse", "Tuberculosis", "Weight", "Women")		
Murmurs. (See "Heart")		
Mutual Life Ins. Co. New Code Impairments. Carber	XIX	188
Myocardial Degeneration, Coronary Thrombosis. Lambert. *Cook, Rogers, Old, Wilson, Cragin, MacDonald*	XV	200
Nephritis and Non-Protein Blood Nitrogen. Folin	XVII	319
Nervous or Mental Disease and Selection. Barker. *Grosvenor*	XX	76
Non-Medical:		
Factors Affecting Mortality. Baker. *Lounsberry, Eakins*	XII	211
Insurance. (See "Life Insurance Without Examination")		
Mortality, Male Lives. Scadding. *Rockwell, Baker, Jaquith, Patton, Cragin, Grosvenor*	XV	281
Thoughts Regarding Selection. Rhodes	XI	262
Non-Protein Blood Nitrogen and Nephritis. Folin. *Cort, Benedict, Robinson, Exton, Blatherwick*	XVII	319
Numerical Method of Selection. Rogers, Hunter. *Henderson, Rhodes, Hutcheson, Mead, Sheppard, Coburn, Knight, Symonds, Toulmin*	VI	99

	Volume	Page
Numerical Rating: Selection by Methods Other Than Dwight. *Rogers, Symonds, Patton*	VII	184
Numerical Ratings. Eakins. *Hall, Brown, Cook*	VII	194
Obituaries: (See "Members Deceased")		
Adams, John Lincoln	XVIII	3
Beckett, Wesley Wilbur	XXIII	3
Bennett, Charles Day	XVII	3
Bickerton, Thomas W.	XIX	3
Billings, A. W.	XV	6
Burr, C. R.	XI	7
Carpenter, Willard B.	XXI	3
Chapin, F. W.	XVI	5
Colt, Henry	XIX	4
Craig, T. C.	IX	14
Dillard, Henry K.	XXIII	4
Dwight, Edwin Welles	XVIII	4
Eagleson, J. B.	XV	6
Emery, Z. Taylor	XI	9
Fitzgerald, Paul	XVIII	8
Gadd, Samuel Wesley	XX	2
Gedge, Donald MacColloch	XIII	5
Haines, Ignatius	XI	8
Hall, George Clifton	XII	7
Hall, Joseph Brainard	XIX	5
Humphreys, John Charles	XXI	4
Hutchison, Henry S.	XXI	6
Hutton, Lefferts	XXII	3
Ingalls, Phineas H.	XXI	7
Johnson, A. J.	VIII	31
Kellogg, Edward B.	XIV	9
Knight, W. W.	XI	11
Lines, Ernest H.	XXIII	5
Little, John M.	XIII	9
Lounsberry, Robert L.	XIII	8
McCloud, Charles Naumann	XXII	4
McGreen, Francis A.	XIX	6
McMahon, Thomas F.	XIX	7
Martelle, Henry A.	XVI	6
Mercer, Archibald	XIX	8
Merchant, F. D.	X	32
Miller, W. R.	X	32
Munn, John Pixley	XVIII	9

	Volume	Page
Obituaries: (See "Members Deceased")—Continued:		
Northcott, Edwin M.	XII	8
Paddock, Brace Whitmann	XXIII	7
Peterson, William A.	XII	9
Porter, William Evelyn	XII	10
Post, Albert Todd	XII	12
Priestly, James T.	XIII	6
Stebbins, George S.	XII	13
Strathy, George Stewart	XII	14
Symonds, Brandreth	XI	12
Thorndike, William	XXIII	8
Tiemann, Paul E.	XVII	5
Toulmin, Harry	XVI	7
Truitt, Frank L.	XXIII	8
Turner, John S.	XXIII	9
Turner, Joseph Pinckey	XXII	5
Van Dervoort, Charles Aiken	XIX	9
Watson, William Perry	XII	15
Webb, J. H.	VIII	29
Wehner, William E. H.	XIX	10
Wells, Ernest Alden	XIV	7
Wells, Frank	VI	9
Wells, F. C.	XI	14
Willard, Thomas H.	XXIII	10
Wilson, Gordon	XIX	10
Woley, Harry Percival	XXIII	11
Woolen, G. V.	IX	14
Young, John C.	XIV	8
Occupation and Mortality. Rogers, Hunter. *Foshay, Murphy, Dublin, Fitzgerald*	VII	88
Officers of Association. Listed at Beginning Each Volume.		
Oppenheimer and Master's Table	XVI	59
Oscillometry, Cardiography and Selection. Brathwaite	XVI	19
Overweight and Cancer. Dublin. *Muhlberg*	XV	402
Overweights:		
How to be Treated. *Fisher, McKechnie, Root, Wood, McMahon, Symonds, Gore, Nichols, Van Wagenen*	VI	216
Selection and Statistics. Weisse, Strong. *Ward, Thorndike, Jaquith, Dwight, Rogers*	XII	24
Peptic Ulcers. (See "Gastric Ulcers")		

	Volume	Page
Photo-Electric Scopometer. Exton	XVI	141
Pleurisy and Life Insurance. Martin. *Bartlett, Wilson, Ward*	X	182
Pleurisy and Selection. Dublin, Marks. *Bartlett, Dingman*	XIX	203
Pneumothorax. Bartlett. *Elliott*	XX	90
Poisson's Law Small Chances. Wells	XIX	155
Presidential Addresses. (See "Address: Presidential")		
"Pressprobe" Breath-Holding Test	XVI	48
Prohibition, National, Related to History Intemperance and Sale of Liquor	VI	229
Prostatic Obstruction. Kretschmer. *Lowsley, Cragin*	XXII	183
Proteinuria and Glycosuria. (See "Glycosuria")		
Prudential Longevity Service. (See "Longevity")		
Public Health:		
Committee of Association	VII	243
Committee on VIII, 34; IX, 19;	X	36
Need of Education in. Willard. *Symonds, Beckett, Patton, Wells*	VII	73
Pulse:		
Abnormal, Its Detection, Recognition and Evaluation. Wilson. *Cook, Rogers, Old, Cragin*	XV	192
In Life Insurance. Patton, MacKenzie. *Dwight, Cook, Wishard, Martin*	XIII	221
Intermittent, Irregular, Rapid, Mortality. Rogers, Hunter	XIV	54
Pyuria. Clark. *Carber, Chapman*	XVII	338
Ratings for Principal Impairments. Hunter, Rogers. *Henderson, Rockwell, Toulmin, Weisse, Eakins*	VIII	121
Reminiscences. Van Wagenen	XI	342
Renal Colic, Calculus, Gravel, Mortality. Rogers, Hunter	XV	412
Rheumatism. Rockwell	IX	179
Rheumatism, Inflammatory. Rogers, Hunter. *Russell, Symonds, Eakins, Chapin*	IX	161
Roentgenological Selection, Latent or Non-Clinical Tuberculosis. Cole	VII	354
(See "X-ray")		
Scapular Types and Longevity. Graves. *Dublin, Hoffman, Patton, Rogers*	X	60

Scopometry:
Preliminary Note. Exton ... xvii 301
The Scopometer. Exton ... xiii, 109; xvi 141

Selection:
And Insurance Record. Rockwell. *Van Kleeck, Pollard, Eakins, Fisher* ... xiii 67
By Other Methods Than Numerical Rating. Dwight. *Rogers, Symonds, Patton* ... vii 184
Medical. (See "Medical Selection")
Non-Medical. (See "Non-Medical")

Sex, as Affecting Blood Pressure, etc. Hunter, Rogers ... vi 92

Shell Shock and Gassing. Fraser. *Strathy, Archibald, Martin, Anderson, McCulloch, Whitney* ... vi 74

Southern States, Mortality in. Koeppe, Muhlberg. *Grosvenor, Cragin, Righter, Alton* ... xvii 194

Specific Gravity of Minute Quantities of Urine: Apparatus for Obtaining. Exton ... vii 289

Statistical Principles, Interpretation. Larus. *MacLean, Grosvenor, Eakins* ... xxiii 65

Stomach: Cancer of. Hamilton ... xvi 241

Sugar: (See "Blood Sugar")
Dextrose Tolerance Test: Alimentary. Exton, Rose ... xxi 254
Distribution in Animal Body. Folin. *Benedict, Muhlberg* xiv 428
In Urine, Methods of Detection. Wolf. *Pauli, Balch, Exton* ... vii 316
In Urine: Quantitative Test. Exton, Rose, Wells ... xiv 441
(See also "Glucose", "Glycosuria")

Syphilis:
And Life Insurance Companies. Rein, LeMoine, Stephens xxiii 145
In Relation to Life Insurance. Rein, LeMoine ... xxi 13
Kline Precipitation Test. Rein ... xix 275
Kline Precipitation Test. Stillman ... xxi 23
Study of. Hobbs. *Weisse, Daley, Baker, Rogers* ... xiii 14

Systolic Heart Murmurs. (See "Heart")

Tall Men, Weight Standards and Mortality. Dublin, Marks. *Davenport, Timme, Clark* ... xxiii 153

Thyroid Disease. Lahey. *Jimenis* ... xix 228

Tubercular Cases, Disability and Mortality. MacSweeney ... xii 142

	Volume	Page
Tuberculosis:		
And Mortality. Rockwell, Henderson. *Rogers, Scadding, Weisse*	XIV	396
Bone and Joints. Archibald. *Bailey*	XIV	310
Death and Disability Claims. Daley	XV	246
Diagnosis, Factors Involved. Miller	XI	127
Disability and Mortality. MacSweeney	XII	142
From Insurance Viewpoint. Battle	XV	266
Gastro-Intestinal Tract. Honsberger	XVI	270
Intestine and Peritoneum	XVI	244, 277
Juvenile: Diagnosis and Prognosis. Chadwick. *Knight, Bailey, Wilson*	XIV	327
Lungs and Blood Spitting. Rogers, Hunter	IX	161
Mortality of	XVI	278
Pulmonary: Changing Attitude. Homan. *Ylvisaker, Cort, Dublin, Muhlberg*	XXIII	94
Pulmonary: Roentgenological Selection. Cole	VII	354
Pulmonary: X-ray in Diagnosis. Brown	VII	343
Tuberculosis. Beckett. *Knight, Bradshaw*	IX	115
Tumors, Malignant and Benign. Wood. *Pollard*	XXIII	208
Turbidity Micro Method for Blood Sugar. Rose, Schattner, Exton	XVI	178
Urinalysis. (See "Acetone", "Albuminuria", "Glycosuria", "Scopometry", "Specific Gravity", "Sugar")		
Urinary Analyses, Study of. Brown. *Gordon, Muhlberg*	XIV	343
Urinary Impairments, Committee Report. Patton—XI, 244; XII, 115; XIII, 34; (See "Albuminuria", "Glycosuria", "Pyuria", "Sugar")	XIV	12
Urinary Tests:		
Demonstration of. Clark, Kingsbury	XI	250
The Newer Chemical. Muhlberg	XIII	86
Urine and Blood Sugar, Ingestion 50 Gms. Cane Sugar. Blatherwick	XVII	310
Urologic Surgery. Lowsley	XII	107
Ventricular Fibrillation. Henderson	XVI	117
Vital Capacity	XVI, 42, 127, 136	
Weight: (See "Overweights")		
And Height, Related to Abdominal, Chest Measurements. Thompson, XVI, 352; Clark, XVI, 341. *Weisse, Piper.*		
As Affecting Blood Pressure, etc. Hunter, Rogers	VI	92

	Volume	Page
Weight ("See Overweights")—Continued:		
Over and Under: Mortality. Knight	IX	193
Standards and Mortality Very Tall Men. Dublin, Marks. *Davenport, Timme, Clark*	XXIII	153
Study of Tables of Average Weights for Heights. Clark	XXII	266
Women:		
As Insurance Risks. Strong, Weisse. *Hobbs, Cullen, Scholz, Baker*	XVI	307
Disability Benefits. Ferguson	XV	302
Mortality Experience	XVI	314
Single and Married: Morbidity Compared. Ferguson	XV	350
With Pelvic Operations: Selection and Mortality. Brown	VI	31
X-ray: (See "Fluroscope", "Roentgenological")		
Chest Examinations. Dunham. *Pauli*	IX	132
Diagnosis, Pitfalls in. Chamberlain	XXIII	125
In Diagnosing Pulmonary Tuberculosis. Brown	VII	343
In Evaluating Pulmonary Lesions. McPhedran. *Old, Fellows*	XXI	237
Value in Insurance Examination. Fellows	XVI	266
X-ray and Electrocardiogram:		
And Ordinary Issue. Fellows. *Cragin, Huston, White*	XVIII	202
Procedure. Fellows. *Birchard, Ungerleider*	XIX	15
X-ray or Electrocardiogram and Underwriting. Jimenis, Wilson. *Taylor, Nichols, Ungerleider*	XXIII	18